

**Waves of change:
An analysis of the systematic and
behavioural problems regarding
dripping faucets on Dalhousie
University's Sexton campus**

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Executive Summary

Fresh water is becoming more and more scarce throughout the world. Though Canada is blessed with an abundance of it, more efforts for water conservation are necessary and universities have the opportunity to lead the way. A water audit is an important first step to conservation because it addresses the systematic problem of finding out where the leaks are occurring and can put a quantitative value on the amount of water being wasted. Intercept surveys are a useful purposive sampling technique because they all allow the surveyor to choose exactly who completes the survey. When a qualitative technique like a survey and a quantitative technique like a water audit can achieve the same results or strengthen each other's argument, decision makers are much more likely to take heed to the findings. This paper uses a water audit to answer the question of how many litres of water are being wasted due to dripping taps on Dalhousie University's Sexton campus and where the major problem areas are. The intercept survey attempts to answer the question of whether there are behavioural issues by students, staff, and faculty on Sexton campus that are inhibiting water conservation efforts. The water audit was conducted and the model and flow rate of the aerator was noted as well as how much water was being wasted per year due to drips using a drip gauge container. An intercept survey was given to people on Sexton campus on different days to ensure randomness. The major findings of the paper are that MacDonald B building contributes over half of the total wasted water and that faucets without aerators are much more likely to drip. The findings from the survey show that most people will turn off the tap but if there is a mechanical drip, 61% of respondents do not know whom to talk to about this. Also, 72% of respondents state that more education and awareness (such as signs) is necessary on Sexton campus. In light of these results, we recommend to decision makers to address MacDonald B building by getting rid of all faucets without aerators and replace them with low-flow faucets. Also, since mechanical drips are more of a problem than behavioural drips, there needs to be a sign in the washroom telling people whom to talk to if there is a drip. Further research must be done on how effective these signs are and the toilets, urinals, and water fountains must be audited on Sexton campus as well.

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1. Introduction

Water makes up approximately 80% of the mass of the human body and is essential for everyday life (Sturman, Ho, & Kuruvilla, 2004). Although there is a large quantity of water that surrounds the human population in terms of oceans, there is a decreasing amount of fresh water. It is noted that throughout the next century the world water shortages will multiply quicker than we can fix the problem (Sturman et al., 2004). The challenges that the world will face in the next century will be detrimental to human and species life. Issues such as water scarcity, lack of accessibility to clean drinking water, sanitation and deterioration of water quality will all heavily affect the natural ecosystems of the world (Simonovic, 2001). It has also been noted by the secretary general of the World Meteorological Organization that “Water for the twenty first century will be scarce, will be under increasing threat from pollution, there will be severe periods of flood and drought, and should be the concern and responsibility of all” (Simonovic, 2001). Under these circumstances and predictions, it is crucial that we move towards effective water conservation practices.

Fresh water is a finite resource that is crucial for the development and survival of all living things. For this reason it is important to implement water conservation practices in our everyday life. Water conservation practices are predicated by various psychological factors (Bonnes et al, 2008). People determine whether they believe water is an important resource due to multiple reasons such as motives, values, and beliefs. It is more likely for people to participate in water conservation initiatives when their motives, values, and beliefs are centered on the value of water and when they are aware of water scarcity problems and the seriousness of water depletion. Water conservation is defined as “limiting or modifying the use of water by human beings, so that our use of water does not cause fluctuations of water quantity quality within any cycle beyond those fluctuations caused by natural events” (Sturman et al, 2004, p. 5). By practicing water conservation, we not only provide social, economic, and environmental benefits on a local scale, but also for the global community as well.

There are many types of water conservation practices that can contribute to successful water conservation. One of which is a water audit. A water audit “provides a means to provide precision in schemes for water conservation, water use efficiency and water management” (Sturman et al., 2004). The foundation of a water audit is to measure the quantity and quality of water outputs from within a boundary (Sturman et al., 2004). From this you are able to compare the outputs to the inputs and acknowledge whether or not there has been leakage. Water audits can be very beneficial for large institutions such as universities because they show the amount of water being lost due to certain inefficiencies of taps. Water audits allow for reduced water losses, financial improvements, more efficient use of existing supplies, and improvements to public health and property (American Water Works Association, 1999). A water audit is a tool that helps control water usage and promotes water conservation practices in residential, industrial and commercial establishments.

2. Background Information

Fresh water is becoming the world's most essential natural resource and will only increase in value as time goes by. Awareness for water conservation has started to become more important as supply slowly dissipates. The planet's surface is composed of approximately 70 percent water (Environment Canada, 2007). However, salt water (which is undrinkable) makes up 97.5 percent of the world's surface water (Environment Canada, 2009). Canada has an abundant amount of fresh water in comparison to the rest of the world with about 25 percent of the world's wetlands and rivers accounting for 7 percent of the world's renewable water supply (Environment Canada, 2007). In terms of freshwater, Canada is a key controlling factor in terms of global supply. Water audits are a new tool that have helped Canadians discover inefficiencies in water systems and discover an approximate number of litres of water wasted in an given area. Water audits are defined as "A thorough accounting of all water into and out of a utility as well as an in-depth record and field examination of the distribution system that carries the water, with the intent to determine the operational efficiency of the system and identify sources of water loss and revenue loss" (Public Affairs Department, Philippines, 2008). Unfortunately, global water use is increasing at double the population rate according to Kristy Jenkinson of the World Resources Institute. Freshwater use is the only form of clean drinking water. So far there is only 2.5 percent of the world's water that is fresh with two-thirds of it being frozen (Zabarenko, 2011). Given the centrality of water to our everyday lives, there has been a massive increase in water awareness around the globe. Freshwater management has been included in the world's Millennium Development Goals and there needs to be a great deal of improvement in efficient water use in order to achieve this goal (GIWA, 2006).

Water audits can be put to real life use to help businesses become more efficient and environmentally responsible. The graph below displays information on businesses that used a water audit and shows the benefits of following the recommendations created by the tool (Capital Regional Water District , 2012):

3. Literature Review

World population will increase by 2 billion, reaching 9 billion by 2050 according to United Nations projections (United Nations, 2012). This forecast leaves the present global citizenry challenged with a major problem. An attainable solution for water conservation must be adopted in order to manage and sustain projected water use. Like oil in the 20th century, water is becoming an essential commodity in the 21st century (Zabarenko, 2011). Changes in societal lifestyles have driven up the demand for water due to increased migration to urban areas, which has resulted in a major increase in urbanization, development and population growth.

Water auditing provides the first step towards successful water conservation initiatives as it gives business and education facilities an outline of major problems

within their system. Business, educational institutions and residential homes are currently faced with rising water consumption rates while at the same time are subject to water use restrictions (Jones, 2013). Water audit uses, such as the identification of infrastructure shortcomings, can help provide business as well as home owners with valuable information and lead to monetary savings and water conservation.

The purpose of this research project is to identify inefficient water use and assess the level of water conservation awareness on Sexton campus, Dalhousie University. Due to the multi-dimensional characteristics of this project, we conducted literature reviews for both the qualitative and quantitative research questions.

Qualitative

Rosenbloom describes a qualitative approach for dealing with sustainability and water conservation (2010). The social aspects of sustainability of this piece will help the group define the focus of the student demographics as well as identify the faculty for our research. In addition, Rosenbloom summarizes the advantages of water, energy and waste audits to help identify retrofit as well as cost-saving opportunities. The article questions whether universities are doing enough to promote sustainability considering they are supposed to be creating the leaders of tomorrow. An article by Billy Comeau about Camila Das Gupta and her challenge with creating a more sustainable planet will also inspire our survey questions on water conservation and empowerment for environmental responsibility and stewardship (2010).

Gilbertson et al. discuss water conservation attitudes and behaviors in two different communities in Australia (2011). The article assesses peoples' attitudes towards water conservation and their actual participation in local water conservation initiatives. Importantly, these two communities have very different water conservation needs and therefore it is important to correlate how they feel towards water conservation initiatives and whether or not they will take action to support these initiatives. This research contributes to our project's qualitative research question for Dalhousie University's Sexton campus because it will give us insight into peoples' social behaviour with regards to turning taps off. This article demonstrates a definite correlation between background and behavior. This is a central focus of our qualitative analysis because we will be asking questions that will allow us to be better acquainted with people's backgrounds and attitudes. Once we have compiled this information, we can see if there is a relationship between how people act when a tap is dripping and how they view water conservation as a whole.

The insight provided by J. Nelson was used in this report to better understand the effects that water audits have in residential settings (1992). The article provides a detailed account of the effects that water conservation awareness has within communities and what type of social expectations to expect from the survey results. Water audits of single-family homes in suburban areas proved that the general population did not realize they waste large volumes of water. Thus, our group expected possible poor level of awareness from the student population.

In Spencer's article, "Pros and Cons of Intercept Surveys", she provides a detailed report on the proper circumstances that are required to conduct a legitimate intercept survey (2008). The intercept survey was a key tool for this report and it was essential that it provide accurate results in order to correctly interpret the data. Our research project aimed for immediate impressions, to catch the respondent when their feelings and opinions are still fresh in their minds. The intercept survey was the ideal qualitative tool for our research as it was able to tap into respondent's first reactions to water conservation. In addition, Wang's article comprised the ideals of efficiency when using an intercept survey (2010). Time is used efficiently as the research gets instant feedback with no need to follow-up with respondents at a later time. This allows our group to conduct our research with a representative sample population in the short timeframe of the semester. The intercept survey is also cost-effective as it is administered to volunteers and the only expense is printing the survey instruments. This suited our qualitative research requirements, as there were no funds allocated to this project.

Quantitative

Allon & Sofoulis' article is important because it speaks about a project concerning domestic water use and how it affects natural resource policy and practice in Australia (2006). This will help our group gain knowledge and understanding of water conservation policies and practices in areas that have extreme water preservation issues, particularly because Australia has more experience dealing with these types of problems compared to Canada. This will help us with our quantitative section because we will be able to compare how stiffer rules and regulations affect local institutions like universities. If need be, we can analyze how much money could be saved if Dalhousie were to adopt more ambitious water conservation strategies like those in Australia even though it is not mandated to do so by the Canadian government.

Dalhousie University has released a fact sheet that deals with responsible water use (2008). This helps inform our research by offering background information on current and past policies. The facts sheet goes into detail about the money saved by being water efficient and also highlights some tips for conserving water in the home, within the community, and at work. One fact that was very interesting is that 40% of all toilets at Dalhousie leak. The fact sheet will be integral when we need to suggest improvements that need to be made, once our results are analyzed.

Water use efficiency can be achieved by improving its means of delivery, specifically in terms of faucets. Draper states that Canadian residents use about 343 liters of water a day and approximately 70% of is used in washrooms (2007). This number is a clear representation of water use abuse in Canada as the survival rate of water use for the average person is 5 liters a day. Canada is the second highest user of water in the world behind the United States (Gleick, 2000). Since faucets are the primary source of dispersal there is strong incentive for them to operate at maximum efficiency. In a statement from BC Hydro, aerators that are installed on faucets allow up to 40% of water conservation from hand washing in private and public washrooms. This is why it was

imperative for our group to audit the faucets that did not have aerators in order to assess inefficiencies.

Environment Canada's webpage on water audits was essential in providing guidelines on how to properly conduct a water log (2009). Although we were given our own guidelines on how to measure and keep water logs as well as how to measure water flow, it was beneficial to conduct research on the Canadian government standard. The webpage communicated the proper procedures for water measurement on toilets, not just sinks. This process was explained in further detail by the University of California webpage on water audits, while also including information on urinals. Although this measurement is not included within this specific research scope, it was a vital for the group to comprehend the full extent of a detailed water audit.

Another resource that we plan to use is a past project called "Dalplex Water Audit" by Richardson-Prager et al (2004). This resource will be used as a template and reference model. It goes into depth on descriptions of the assessment, on the interview process, and on research and cost. Because the audit took place on the Dalhousie campus, there is a lot that we can take from the study and we also have first hand knowledge of the places described. Another similar resource is an article on Virginia Commonwealth University's attempt at a new water management plan (Allison, 2011). As universities undoubtedly have a large effect on the water usage in their surrounding area, it is important that water is managed efficiently. This is especially true of Dalhousie University, a large university that has a large residual effect on the surrounding Halifax Regional Municipality. Virginia Commonwealth University also evaluates all of their water inefficiencies on campus. While we are only evaluating leaking faucets, this study may provide insight into other water inefficiencies that may be present on Dalhousie's campus (Allison, 2011). These water inefficiencies are then met with potential fixes, which is something we also hope to achieve with our water audit.

4. Statements of Goals and Objectives

As a group we decided to craft two research questions because we thought that our project should incorporate quantitative and qualitative aspects. The two main goals of our project were to answer the following questions:

- 1) How much water is being wasted in Litres (total) and where are the most of these inefficiencies stemming from on Sexton campus?
- 2) Are there any behavioural tendencies of students, faculty, and staff on Sexton campus that limit or enhance water conservation?

To accomplish these goals, our group proposed using small objectives as stepping stones so we would be able to effectively and efficiently answer our research questions. Our objectives were as follows:

Objectives	Implementation Steps
Research Ethics – Application	<ul style="list-style-type: none"> -Create short intercept survey that will help analyze behaviours towards water conservation on Sexton Campus -Seek approval by the internal College of Sustainability ethics board
Water Audit testing	<ul style="list-style-type: none"> - Go to selected buildings (Medjuck, A.L MacDonald buildings A,B,N,Q, and Gerard) -Find washrooms, check aerators, and find drips. -Objective is to find all faucets that drip and recommend they be fixed or replaced
Intercept Surveying	<ul style="list-style-type: none"> -Goal is to survey at least 75 participants -Walk around Sexton campus high traffic areas (main lobby MacDonald)
Coding	<ul style="list-style-type: none"> -Decode all results from survey and water audit -Find patterns and formulate answers to research question above. -Objective is link quantitative results to qualitative in order to have more influence on decision makers

Table 1: Main objectives of the study

5. Methods

5.1 Quantitative

A water audit was completed on six buildings at the Sexton Campus: MacDonald A, MacDonald B, MacDonald N, MacDonald Q, Medjuck Architecture, and the Gerard residence. The sampling frame was limited to any public faucets in these six buildings. This included all male and female bathrooms as well as any public kitchens. Any private property that was not open to students was not part of our study. A water audit was chosen because it addresses the systematic problem by finding out where the main leaks in the system are occurring (Thornton, 2002). It allows further studies such as a cost benefit analysis to be completed (Fane & White, 2001). A water audit is highly structured

meaning that results are reliable and trustworthy because they can easily be replicated (Thornton, 2002). The water audit sheet that we used for our project (Appendix 4) was used by other researchers in previous years and was also given to other groups performing a water audit this year as well.

Using the given water audit sheet (Appendix 4), our duty as researchers was simply to fill it in. The building was listed at the top of the sheet and the column on the far left was used to describe where the faucet was. For example, a “B” for bathroom or “K” for kitchen was listed first followed by an “M” for male, an “F” for female, or “C” for co-ed if the room was a bathroom. Next the floor level was listed. If there were two or more sinks in the bathroom, the sink on the left was written first and the sink at the far right was written last. In the rare case that there were two rooms both titled “BF3” for example, a room number or an identifying mark was explained in the “notes” column to ensure that there would be no confusion if someone were to replicate the study.

Once the room and tap had been identified, we checked if there was an aerator and if there was the model and flow rate were noted. These were found on the side of the aerator. There were only two types of aerator models that we came across. In Appendix 4, an “M” represents the model A112.18.1M and the “5” signifies the model A112.18.11.5. In the rare case that the sink had an aerator but the model or flow rate was not legible due to grime or wear, a comment explaining this was recorded in the “notes” column. It should be mentioned that another column was added to the flow rate section of aerators because there were several faucets that had a flow rate of 7.6 litres per minute (lpm) and this value was not listed on the audit sheet we were given.

To determine if there was a drip, several steps were taken. These steps were determined after a pilot was completed. Every member of the group tested if there was a drip on five different sinks using three different techniques. When answers were compared, there was only one technique that provided the same answer from each member for each sink. This technique was chosen to be used throughout the water audit because its results were the most trustworthy and reliable. The first step was to check if there was a behavioural drip. This was determined if the sink was dripping upon entering the room, but once a researcher tightened the knobs, the dripping stopped. If this was the case, a “1” was placed in the behavioural drip column. The next step was to turn on the water (both hot and cold if there were two knobs) and let it run for approximately five seconds. The researcher then timed ten seconds on a stopwatch to give the water enough time to flow out of the tap. After those ten seconds were over, a drip gauge container was placed underneath the faucet. This was held there for a further ten seconds. The researchers worked in pairs so that one person could use the stopwatch and the other could control the drip gauge. The drip gauge had indicators on it showing how many of litres of water were wasted due to the dripping tap. This value was written down in the “LPY” column of the water audit sheet. The value was taken at the bottom of the meniscus in the container. If there was a mechanical drip, a “1” was placed in the mechanical drip column.

Because there were only 86 faucets in total, there was little data analysis undertaken. Summary statistics of each building were taken and placed into a table (Appendix 6). Another table was also created to determine the influence of having an aerator on whether there is a mechanical drip (Appendix 7).

The water audit was conducted in a fashion that can easily be replicated. The water audit sheet used (Appendix 5) is easy to use and well organized. The pilot test ensured that each researcher's work was reliable and trustworthy because a method was established before the project began. By working in pairs when completing the audit, we ensured that one person could time while the other held the drip gauge. The audit for every building except for Gerard was done on Friday March 15th to make sure that doing the audit on a different day would not affect results due to usage patterns. Thornton states that people are more likely to use more water on different days and that could have affected our results (2002). Gerard was completed the following Friday (the 22nd) simply because we were not given permission by the facilities manager in time to do the audit there on the 15th. Considering the fact that a pilot test was completed to determine a method that was 100% reliable, we are confident that all 86 results are reliable and trustworthy. Our results are valid as they address our research problem by giving a value on how many litres per year each faucet is wasting due to dripping taps. Our results are trustworthy because they are clearly documented in Appendix 4 so that any person could find the faucet and complete the same steps we did.

The major limitation for water audit was time. If there was more time than just part of a semester, all of the buildings on Sexton campus could have been audited. Nevertheless, a limitation was placed on our group to only complete six buildings so that our project could be completed on time. A water audit, if done correctly, is quite tedious and time consuming (Thornton, 2002). Another limitation was that we required permission to enter the Gerard residence building and the facilities manager did not respond to our emails or calls in time to complete the audit when we were doing all the other buildings. This may have affected results. Since we only did the water audit once for each building, it is possible that there could have been some discrepancy on the number of behavioural drips. We would like to note that the number of behavioural drips could change on a day-to-day basis but due to time constraints, only one audit of each sink was completed. The only delimitation of the study was that we waited ten seconds after we turned the water off. Thornton notes that some taps may stop dripping after a minute or two and so our study would not have accounted for that (2002). Further research could be completed using our same steps but waiting one minute after the tap is turned off to see if this is a factor with certain faucets on Sexton campus.

5.2 Qualitative

An intercept survey was conducted at Sexton campus to determine some of the behavioural tendencies contributing to drips. This qualitative section was used to help achieve some triangulation within the project. The reason an intercept survey was chosen was to ensure that every person who completed the survey does actually spend time at Sexton campus. Sexton campus is a relatively new addition to Dalhousie University and

not many students, faculty, or staff have much of a reason to go down there. Therefore, to ensure that we received results from the people we wanted, we used this purposive sampling technique. Though we would have liked for the intercept survey to be probabilistic, we did not receive enough surveys for the results to be considered representative of the population. We determined the population to be all students enrolled in the faculties of engineering and architecture as well as all people living in either the O'Brien or Gerard residences. There were 387 students enrolled in architecture and 2001 students enrolled in engineering in the 2011- 2012 year (Dalhousie University Office of Registrar, 2011). There are 241 students living in Gerard residence and 115 living in O'Brien Hall (Dalhousie University – Residences, 2013). There are an estimated 95 faculty and 45 staff in the engineering department (Dalhousie University Faculty of Engineering, 2013). This equals 2884 people and using an online calculator (with a confidence level of 95% and confidence interval of 5), we determined that the sampling size had to be 339 to be reliable and trustworthy (Creative Research Systems, 2012). Unfortunately, we were only able to get 75 surveys due to several limitations.

The reason we chose an intercept survey was to ensure first of all that the person being surveyed is actually is on Sexton campus at least once a week. By completing the surveys there, we could ensure this. Secondly, intercept surveys are advantageous because the researcher is right there to make any clarifications about questions when the subject is completing the survey. This certifies that the person knows exactly what the question means and can therefore give a more honest and informed answer (Atchison & Palys, 2008). Also, an intercept survey allows a researcher to control the representativeness of the population. For example, if the ratio of students to staff is 1:20 and there are no staff surveys in the first 40, the researcher can actively seek out a staff member (Atchison & Palys, 2008). Finally, as Spencer states, people are more likely to fill out surveys if someone asks them to in person rather than getting an email asking to fill out an online questionnaire (2008). Spencer also notes that sometimes only people who are interested in the questionnaire will fill it out online, which causes a bias (2008). Asking random people minimizes this risk as very few people will decline.

Appendix 3 shows the questions that we asked people on Sexton campus to fill out. Each person in our group went to Sexton on a different day and attempted to get 15 people to fill out surveys. A person went on Monday, Tuesday, Thursday, Saturday, and Sunday and no one was allowed to tell the others where they went to complete the surveys to ensure randomness. The researcher would approach someone and ask them if they could take two minutes to fill out a survey about water conservation on campus. The researcher made it clear that the person should ask if they had any questions or clarifications about the survey and they hovered close by should that occur. Once the survey was completed, the person was thanked for their time and the survey was placed in the pile.

Because our sampling frame was not nearly large enough to be considered reliable, our data analysis focused on major trends and specific questions. We did not focus on any links between what department people are in or whether they were faculty, staff, or students simply because our conclusions would not be valid or trustworthy.

However, some questions had incredibly high percentages of people that wrote the same thing so we focused on these. Summary statistics of every question were determined (Appendix 8). From there, some trends in questions became quite obvious. A table was made showing the answers of all participants on question 6C (Appendix 9). A table was also made for question 9 as most people answered the same thing (Appendix 10).

Some of the questions had the purpose of achieving catalytic validity for the person being surveyed. Questions 5 and 8 asked people to critically examine how important water conservation or environmental stewardship respectively was to them. Question 9 asked people how Sexton could do a better job at reducing water usage. These questions hopefully made people, perhaps just for the day, more conscious about their water consumption and may impact some people to take action. By asking people how they would deal with an issue, Atchison & Palys suggest it could spark certain people to take action (2008). The survey is reliable in the sense that the study could easily be replicated considering that the questions asked are provided in Appendix 8. It is also valid because the survey results uncover some important behavioural issues regarding water conservation. However, the results are not trustworthy because the sampling frame is far too small.

Again the major limitation was time, and that was reason behind the delimitation to only complete 75 surveys. All of the researchers are studying full time and the water audit was quite time consuming so unfortunately very little time could be allocated to the survey. Further study is required to see if the results found in this study could actually prove to be trustworthy when the necessary sampling frame is achieved. A limitation is the issue that people may lie in surveys because they write what they think what the surveyor wants to hear (Atchison & Palys, 2008). Because of the delimitation of deciding to get only 75 surveys, we were limited in what we could do for data analysis as there were too few results to make conclusions about the difference between faculty and students for example. We had to focus on major trends.

6. Results

After both our quantitative and qualitative research of a Sexton Campus Water Audit, we came across a few different results. For the physical water audit, we audited Gerard Hall, Ralph M. Medjuck Building, AL MacDonald Buildings A, B, N, and Q. Table 2 shows that Gerard has a total of 33 faucets, 5 of which have mechanical drips. This totaled to 31,700 litres of wasted water per year. Next was Medjuck that had 16 surveyed faucets, 3 of which have mechanical drips for a total of 40,150 litres of water wasted per year. MacDonald A was found to have three public faucets, none of which had any drips. Next was MacDonald B with 22 public faucets. 9 of these faucets had mechanical drips, wasting 188,340 litres of water per year. MacDonald N has 7 faucets, 2 that dripped for a total of 81,030 litres of water dripping from taps every year. Last, there was MacDonald Q that has 5 faucets and 1 that dripped, wasting 13,505 litres of water per year. Overall, there were 86 public faucets and 20 of them had mechanical drips. As seen in Table 2, together, these drips amounted to a total waste of 354,725 litres of water

per year. It is also apparent that MacDonald B had the greatest water inefficiencies concerning leaking faucets.

Building	Total number of public faucets	Number of mechanical drips	LPY
Gerrard	33	5	31700
Medjuck	16	3	40150
MacDonald A	3	0	0
MacDonald B	22	9	188340
MacDonald N	7	2	81030
MacDonald Q	5	1	13505
Total	86	20	354725

Table 2: Summary statistics of Appendix 3 comparing the number of mechanical drips and litres per year wasted due to these drips at all six buildings that were audited.

Another important result was the number of faucets that had aerators compared to the number of mechanical drips. Table 3 shows that there are 66 sinks out of 86 that have aerators. Out of these 66 faucets, 57 are drip-free, 7 have mechanical drips and 2 suffered from behavioural drips (Appendix 3). The remaining 20 faucets do not have aerators and 13 of these suffer from mechanical drips while the other 7 are drip-free.

Type of Faucet	With Aerator	Without Aerator
Drip-Free	57	7
Mechanical Drip	7	13
Behavioural Drip	2	0

Table 3: Summary statistics of water audit comparing the effects of aerators

We also did an intercept survey to gauge peoples' awareness of water on Sexton Campus as well as feelings towards water conservation. Much of our survey ended up being inadmissible, though we did pick out a few points that we believe say something about peoples' behavior towards water conservation. In total 75 people were surveyed. Important results are the answers to questions 6C and question 9 (Appendix 5). Question 6C asks if the respondent would know who to talk to if they notice a mechanical drip. Figure 1 shows that 61 percent of respondents do not know who to talk to. Question 9 asks what the respondent thinks it would take to make people on Sexton Campus more concerned about water conservation (Appendix 5). Figure 2 shows that an alarming 72 percent of respondents this more education and awareness is necessary.

Figure 1: Responses from intercept survey to question 6C: When you notice a dripping faucet and cannot fix it yourself, would you know who to notify about the problem? (Appendix 4)

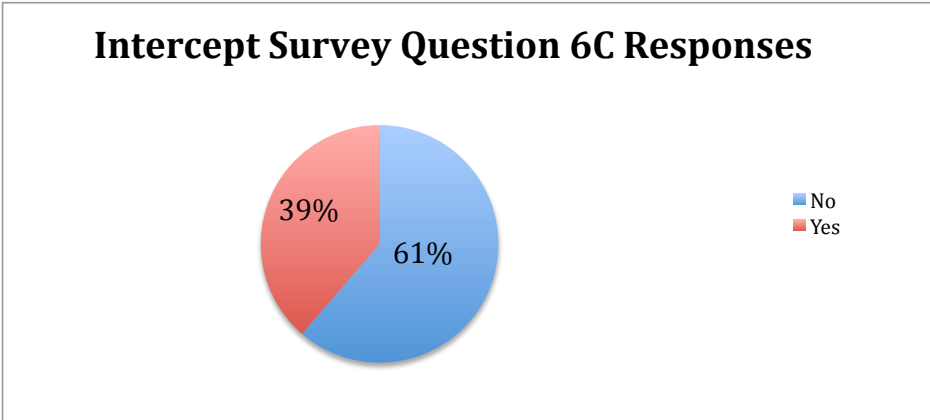
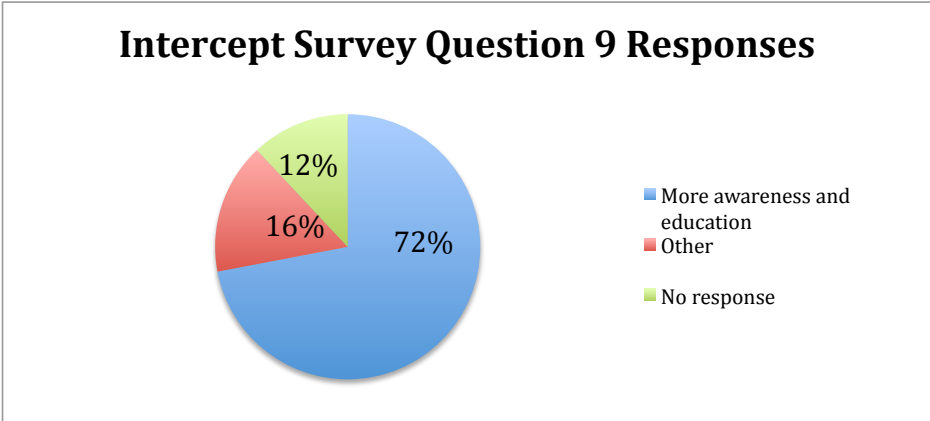


Figure 2: Responses from intercept survey to the question: What do you feel it would take to make people on Sexton Campus more concerned about water conservation? (Appendix 4)



7. Discussion

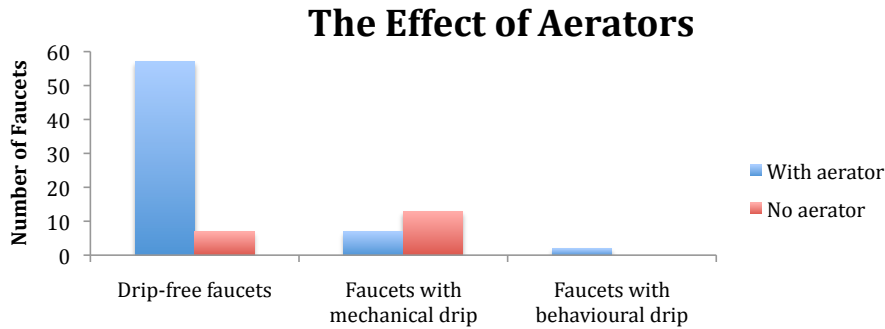
7.1 Summary of Research Questions

The purpose of our water audit was to find out how much water in litres is being wasted on Sexton Campus (in six areas) from dripping faucets every year. Also, we wanted to find out exactly where these inefficiencies were stemming from, or if there was a pattern as to why faucets leaked or did not leak water. The qualitative aspect of our research focused on attempting to uncover student, faculty, and staff's views and behaviours towards water use and conservation. This would have allowed us to link some of the major behavioural problems of people of Sexton campus to the results of the water audit. This would help to serve as a starting point to help Dalhousie University's Sexton campus increase their environmental stewardship over water usage, and help fix water inefficiencies and increase water awareness.

7.2 Significant Findings

There were several points that we found significant through our research concerning both the water audit and the surveys. First, as stated before, there were a total of 88 faucets that were audited and a total of 20 had mechanical drips, resulting in 354,725 litres of water wasted per year. Out of these 20 mechanical drips, 13 of them did not have an aerator on the faucet, or 65%. Compared to the remaining faucets with aerators, 59, only 7 of these dripped, or 11.9%. This can be seen below in Figure 5. Here, it can clearly be seen that faucets that have no aerators on them are more likely to drip than faucets that do have aerators on them. Moreover, we found two behavioral drips during our research. One of these behavioral drips was in Gerard Hall, and if it dripped at that rate for one year it would waste 6,570 litres. The other behavioral drip was found in McDonald A, which would also waste 6,570 litres per year if it dripped continually. While behavioral drips can contribute to a significant amount of water wasted on Sexton Campus every year, it is apparent that behavioural drips are not a dire problem on Sexton Campus. The major behavioural issue that this can be linked to is shown in Figure 1 where 61% of people do not know who to talk to when there is a drip. People on Sexton campus are careful to turn off the tap but will not go out of their way to locate someone to help fix a drip.

Figure 3: An analysis of the effect of aerators using summary statistics from the water audit of Sexton Campus (Appendix 3).



Another important finding was that MacDonald B building is by far and away the worst building when it comes to mechanical drips. Out of the 20 mechanical drips, 9 of them come from MacDonald B (Figure 4). MacDonald B also accounts for over half of the total amount of water wasted per year due to drips (Figure 5). Now that one building has been highlighted as the major problem, significant action must be taken there first before the secondary buildings are addressed.

Figure 4: Analysis of the amount of mechanical drips in the six buildings on Sexton Campus where the water audit was completed (Appendix 1).

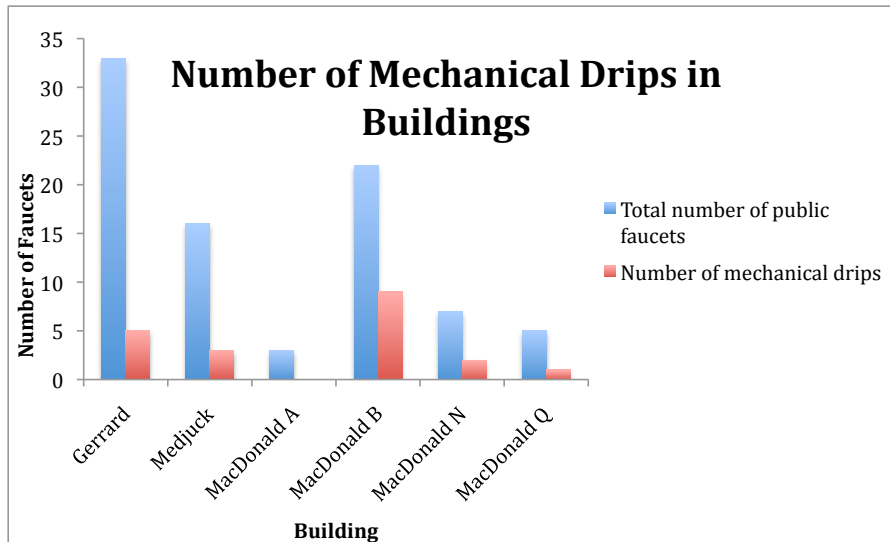
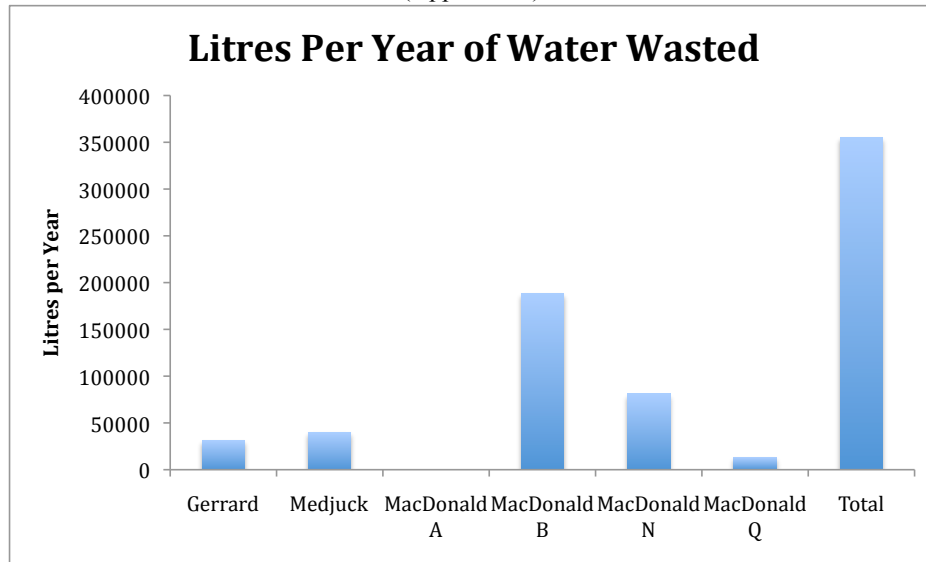


Figure 5: The litres per year of water wasted due to dripping taps in each building
(Appendix 2)



Through our intercept survey we found that overall, there did not seem to be an overwhelming amount of action towards water conservation. As seen in Figure 1, the majority of respondents would not know whom to contact in the case of a problem with a faucet. This clearly shows that even if there is a problem with a dripping tap, the majority of the population would not know who to notify about the issue. From this we can deduce that people would likely leave the sink alone in such a situation, allowing water to waste and leaving for someone else to deal with the problem. In Figure 2 we can see that it seems as though most people are open to the idea of improving water conservation and behavior towards water on Sexton campus. Moreover, if behaviour and stewardship on campus were improved it would most likely transfer into the everyday lives of the people on Sexton Campus, allowing more water to be conserved.

8. Conclusions

8.1 Major Contribution of Study

This water audit of Sexton Campus told us that many of the faucets need to be changed as to stop any mechanical dripping. Many of the dripping faucets seem to stem

from faucets that do not have aerators on them. From observing faucets without aerators, they did seem to be much older models compared to faucets with aerators. Therefore, the simple fix of replacing old faucets with new ones should help mitigate the waste of water through leaking faucets. Moreover, every aerator type has a different flow rate, and therefore lets out different amounts of water every minute. If faucets were replaced with low flow aerators that let out less litres of water per minute, then if a drip does arise, less water will be wasted due to the flow of the faucet. From our intercept survey, we gathered that people might have an interest in being educated about water conservation. A lack of motivation to be concerned about water is apparent, and therefore this needs to be changed through various informative methods. Another important factor is that over half of respondents to the survey do not know who to talk to if they come across a mechanical. This has to be reduced so that decision makers can hear about the issues quickly so that progressive action can be taken.

8.2 Recommendations for Action

All faucets without aerators should be replaced with new faucets that have low flow aerators. The first building that needs to be addressed is MacDonald B because it wastes nearly 200 000 liters per year of water. We suggest that the first step should be replacing all taps in MacDonald B that do not have an aerator. Secondly, all taps without aerators in every building should be replaced with a low-flow faucet. Finally, all taps that drip should be replaced so that water and money can be saved. Progressive rather than retroactive action is required. Moreover, as per request of the surveyed students, faculty, and staff, there should be focus on awareness and education about water conservation and usage. This awareness may be through informative posters in and around washrooms. People also need to be informed on who to contact and how to contact them in the event of something such as a dripping faucet. This way, faucets can stop dripping sooner and less water can be wasted every year.

8.3 Recommendations for Further Research

Further research should occur, first, in all other locations of Sexton campus. There are many buildings that we did not audit that undoubtedly also have many leaking faucets. Every building on Dalhousie should be audited. Particular focus should be paid to the older buildings on campus that would be more likely to have faucets that are outdated, have no aerators, and are no longer functioning properly. There should be research conducted on the effectiveness of different social actions and what sort of effect they have on the campus populations' attitudes and behaviors towards water usage and conservation. This way, Dalhousie University would know how to go about informing people about the importance of efficient, working faucets and overall water usage. A study could also be completed to determine the effectiveness of a sign in the washroom telling people whom to contact if they see a mechanical drip. Should this prove effective, Dalhousie may want to consider placing these signs in all their washrooms. Then all faculty, students, and staff can be used as investigators rather than a few staff that are already quite busy.

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10. Acknowledgements

We would like to thank Dr. Tarah Wright and Rochelle Owen for their guidance and suggestions throughout this project. We would also like to thank our mentor Paul Sylvestre for his guidance throughout the water audit of Sexton Campus. His knowledge

of audits proved to be invaluable for our study and was the main reason that the audit went so smoothly.

11. Appendices

11.1 Ethics Review

**ENVIRONMENTAL SCIENCE PROGRAM
FACULTY OF SCIENCE
DALHOUSIE UNIVERSITY
(version 2010)**

**APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS
UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

GENERAL INFORMATION

1. Title of Project: Water Audit Sexton Campus

2. Faculty Supervisor(s): Tarah Wright / Paul Sylvestre **Department:** Sustainability
e-mail: Tara.Wright@Dal.ca paulosylvestre@gmail.com **ph:** 902-494-3683

3. Student Investigator(s): Mary-Kate Doyle, Kieran Hooey, Ciara Gallagher, Nick Bertrand, Sebastien Anderson **Department :** Sustainability **e-mail:** mkodoyle@gmail.com
ph: 902-999-3083

4. Level of Project: Non-thesis Course Project [] Undergraduate [] Graduate []
Specify course and number: 3502 ENVS/SUST Campus as a Living Lab

5. a. Indicate the anticipated commencement date for this project: March 15, 2013
b. Indicate the anticipated completion date for this project: March 29, 2013

SUMMARY OF PROPOSED RESEARCH

- 1. Purpose and Rationale for Proposed Research:** *Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated*

The research questions to be investigated include both qualitative and quantitative aspects. They are: How much water is being wasted in liters (total), and where are most of these inefficiencies stemming from on Sexton Campus? What role do the staff and students play in the water inefficiencies on Sexton Campus? The

purpose of this project is to identify any water inefficiencies in taps in public bathrooms and sinks on Sexton Campus, and their connection to the students and staff on the campus as well as their connection to the types of aerators on these sinks.

2. Methodology/Procedures

a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study.

- Survey(s) or questionnaire(s) (mail-back)
- Survey(s) or questionnaire(s) (in person)
- Computer-administered task(s) or survey(s)
- Interview(s) (in person)
- Interview(s) (by telephone)
- Focus group(s)
- Audio taping
- Videotaping
- Analysis of secondary data (no involvement with human participants)
- Unobtrusive observations
- Other, specify _____

b. Provide a brief, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, the use of a flow chart is recommended.

- Create survey
- Create script
- Approach students or staff on Sexton Campus with script and attain their consent
- Have willing participants take survey
- Analyze results

3. Participants Involved in the Study: Indicate who will be recruited as potential participants in this study.

Dalhousie Participants:

- Undergraduate students
- Graduate students
- Faculty and/or staff

Non-Dal Participants:

- Adolescents
- Adults
- Seniors
- Vulnerable population* (e.g. Nursing Homes, Correctional Facilities)

**Applicant will be required to submit ethics application to appropriate Dalhousie Research Ethics Board*

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited, provide a justification for this.

The people we are looking to take our survey involve those employed (both staff and faculty) on Sexton Campus as well as students who study and/or live on Sexton Campus. This will include males and females of any gender, and a large age range due to the possibilities of younger and older students, staff, and faculty.

c. How many participants are expected to be involved in this study? 50 -100

4. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

- Dalhousie University undergraduate and/or graduate classes
- Other Dalhousie sources (specify) _____
- Local School Boards*
- Halifax Community
- Agencies
- Businesses, Industries, Professions
- Health care settings*
- Other, specify (e.g. mailing lists) Intercept survey on Sexton Campus

* Applicant may also require ethics approval from relevant authority, e.g. school board, hospital administration, etc.

b. Identify who will recruit potential participants and describe the recruitment process.

Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts in the appendices section.

See appendix for script

5. Compensation of Participants: Will participants receive compensation (financial or otherwise) for participation?

Yes No If Yes, provide details:

6. Feedback to Participants

Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement. Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.

There will be no feedback letter due to the anonymity of this intercept survey.

POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the

participants from their involvement in the project.

There are no direct benefits to the participants from their involvement in the survey. However, it may further the knowledge of water inefficiencies on Sexton Campus concerning dripping taps. This will allow us to find how much water is being wasted, and potentially how to fix these issues. Participants will enjoy a more water-conscious Sexton Campus.

2. Identify and describe any known or anticipated benefits to society from this study.

There are no known benefits, however society may also enjoy a more water conscious Sexton Campus that will hopefully translate into a more water conscious Halifax Regional Municipality. (what about economic benefits?)

POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors and burdens.

- No known or anticipated risks Explain why no risks are anticipated: There are no mentally taxing questions on the survey, and it is anonymous.
 Minimal risk * Description of risks:
 Greater than minimal risk** Description of risks:

** This is the level of risk associated with everyday life. ** This level of risk will require ethics review by appropriate Dalhousie Research Ethics Board*

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

There are none because there are no known or anticipated risks.

INFORMED CONSENT PROCESS

Refer to: <http://pre.ethics.gc.ca/english/policystatement/section2.cfm>;

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

- Information letter with written consent form; provide a copy
 Information letter with verbal consent; provide a copy
 Information/cover letter; provide a copy
 Other (specify) Willing participants will be approached with an information script about the survey and they will then verbally consent to participating

2. If written consent cannot be obtained from the potential participants, provide a justification.

ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Explain the procedures to be used to ensure anonymity of participants and

confidentiality of data both during the research and in the release of the findings.

No personal names will be used throughout our survey or study, the participants will remain anonymous throughout the entire process.

3. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.

-The surveys will be kept in a locked drawer one of the facilitator's houses, until they are shredded. However they will be transferred to a password protected computer

4. Indicate how long the data will be securely stored as well as the storage location over the duration of the study. Also indicate the method to be used for final disposition of the data.

- Paper Records
- Confidential shredding after March 29
- Data will be retained until completion of specific course.
- Audio/Video Recordings
- Erasing of audio/video tapes after _____
- Data will be retained until completion of specific course.
- Electronic
- Erasing of electronic data after Five years on a password protected computer
- Data will be retained until completion of specific course.
- Other _____

(Provide details on type, retention period and final disposition, if applicable)

Specify storage location: Under lock and key at a facilitator's house, then to be kept on a password protected computer.

Appendices: ATTACHMENTS Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials:** A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s).** Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s).** Used in studies involving surveys or questionnaires.
- Materials:** A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.

SIGNATURES OF RESEARCHERS _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

11. 2 Copy of Preliminary Proposal

Dalhousie University Sexton Campus Water Audit

An analysis of technological and behavioural issues
concerning water conservation

Sebastien Anderson, Nick Bertrand, Mary-Kate Doyle,
Ciara Gallagher, Kieran Hooey

February 22, 2013

SUST 3502

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Comment: Very clear and well organized, however page numbers required

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1. General Project Information

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Comment: Great use of headers

1.1 Project Definition

The SUST 3502 class of 2013 has been requested to work on a variety of environment and sustainability projects to investigate student and staff awareness and knowledge about environmental concerns throughout the Dalhousie University campus. Our group has chosen to conduct a water audit on Sexton Campus because we are all very passionate about water conservation. Because of our diverse backgrounds, we will be able to effectively observe, analyze, and reflect upon the water tribulations on Sexton campus. Our group believes that by evaluating the building fixtures and faucets throughout Sexton campus we can gain a better understanding of the technological challenges that hinder water conservation efforts. Water conservation is a technological problem as much as it is a behavioural problem. Our group will analyze the environmental stewardship displayed by students, staff, and faculty that frequent the Sexton campus and also gauge how aware they are of water conservation issues.

Jennifer Organ 13-4-12 7:02 PM

Comment: This section should be less about personal interests in the project and more about the larger issue this project speaks to, how Dalhousie fits into this picture and how this project will speak to this particular issue (including research questions and brief intro to methods)

1.2 Scope

The water audit will focus on all public sinks and water meters within the Dalhousie University Sexton campus. The project will also explore the social and behavioural aspects involved with water conservation, such as finding a correlation between environmental stewardship and student and staff awareness of water conservation and preservation. The goal and purpose of this project is to gain an understanding of water audits and how water audits can be used to evaluate water systems and locate their inefficiencies. The project as a whole will allow our group to be able to establish relationships between the technological and behavioural aspects involved within water conservation and sustainability stewardship.

Unknown

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Unknown

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1.3 Limitations / Delimitations

Within this type of project there are bound to be some complications or limitations. For example, the timing of the audit can have an adverse effect on our survey respondent numbers and results. Depending on the time of day and day of the week, Sexton campus may be highly unpopulated leaving our group members little to no students and staff members to survey. Our group members will not be able to determine the time of day that will be most busy on Sexton campus or the time of day that will receive the most responses with our surveys. Time, in terms of the amount of time our group has to complete this project, is also a limitation. For our group to gain thorough results of the project, we may require more time than we were given but this is not in our control. Our group's understanding of water facilities and how to measure and conduct a water audit is also a limitation our group faces considering none of our group members have a background in conducting audits or working with water facilities. Another

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Comment: This is not reflected in the research questions you developed.

Jennifer Organ 13-4-12 7:02 PM

Comment: While I appreciate this as a stand alone section, I also think it can be incorporated into the above project definition, as well as your research questions.

Unknown

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Jennifer Organ 13-4-12 7:02 PM

Comment: You can probably look into class times, etc or observe beforehand what times of day are generally busier than others.

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Comment: Explain more clearly how this influences your ability to conduct this research

limitation is that we cannot be certain of how aware students and staff members are of the seriousness of water tap inefficiencies and concerns.

Delimitations within this project are centered around the survey in terms of how our group creates our questions. The questions we ask will have a dramatic effect on the results that we gain through the survey. If our questions are not centered on our research question, we will not obtain the proper results and therefore will not be able to use the results in our project. Another delimitation is the students and staff members that we choose to survey. For example, the results will be affected if we end up surveying more males than females. Also, if our ratio between staff and students that we ask is not equal to the actual population, we will not be able to make strong inferences from our survey.

1.4 Research Questions

Our group decided to create two research questions because our project incorporates quantitative and qualitative aspects. We decided to use a two-question approach because it is much more complicated to combine quantitative and qualitative research into one question. We will obtain the most effective and accurate results by assigning each aspect its own question. Our technological, quantitative question is how much water is being wasted in litres (total) and where are most of these inefficiencies stemming from on Sexton campus? For our qualitative, behavioural research question, we will seek to uncover perspectives of students and staff on Sexton Campus regarding water conservation and how this translates into their behavioural tendencies. Through in-depth research and fieldwork, our group is confident that we will be able to obtain enough information and results to answer both our quantitative and qualitative question.

1.5 Group Expectations

Our group will be analyzing the water usage within five buildings on the Sexton campus by looking at the water pumps and water meters. We will also be conducting an audit on all public sink faucets by measuring the amount of drips. We will be observing student and staff knowledge and awareness of water conservation on Sexton campus through survey. Our group has designed a survey that we will hand out to students and building staff members in order to gain an understanding of student and staff awareness on the topic of water conservation and preservation. We expect that we will uncover certain bathrooms or sinks that need to be replaced or fixed while also determining which building needs to improve its water conservation technology the most. Finally, we expect the survey will show certain trends within students and staff that will explain why people act the way they do. For example, we expect there will be a correlation between the likelihood of a person notifying building staff of a dripping tap and the level of environmental stewardship they perceive themselves to have.

Jennifer Organ 13-4-12 7:02 PM
Comment: I am unclear how this relates to your ability to conduct the study

Jennifer Organ 13-4-12 7:02 PM
Comment: Or the results will not be as valuable/meaningful?

Jennifer Organ 13-4-12 7:02 PM
Comment: Why is this? Cite.

Jennifer Organ 13-4-12 7:02 PM
Comment: Do you mean if you do not survey all students/faculty or if you do not have a specific proportion of students/faculty clarify and cite if needed.

Jennifer Organ 13-4-12 7:02 PM
Comment: This section can be included earlier in the project definition to help situate the reader earlier on.

Jennifer Organ 13-4-12 7:02 PM
Comment: I understand where you are coming from, however this is not necessary to include. Qualitative projects might also have two separate research questions because there are two distinct components to address. So it is not necessarily to accommodate a quantitative and qualitative component.

Jennifer Organ 13-4-12 7:02 PM
Comment: Again, not necessary to include in your proposal. You can simply list the two research questions here for easy reference.

Jennifer Organ 13-4-12 7:02 PM
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Jennifer Organ 13-4-12 7:02 PM
Comment: Not necessary to include this.

Jennifer Organ 13-4-12 7:02 PM
Comment: This is not an expectation - Some of this information might actually better suited in the project definition at the beginning.

Unknown 13-2-28 12:20 PM
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2. Background and Rationale

2.1 Project Rationale

Water is quickly becoming our most indispensable resource and will keep increasing in value during the following years. This resource is important because of its declining availability as it is no longer an inexpensive utility that flows in abundance for our personal energy use and vitality. In the last few years, there has been a mass increase in awareness around the globe on the centrality of water to our everyday lives. Water auditing provides the first step for water conservation within private and public sector facilities as it outlines the major problems within the system. Business and education facilities are facing water rising rates accompanied with water use restrictions due to global population growth, regional droughts (not necessarily this region), and out of date infrastructure.

Energy and resource conservation is an important issue and just like any other form of energy, water must be subjected to conservation agendas in order to reduce its usage. This will increase in significance in the future as the demand for water rises and the supply decreases. There have been numerous studies done within the last decade on water audits due to its increasing value. Our group has focused on finding water audit information from various regions around the world that might possess more experience due to their fragile state concerning water as resource, which is not an issue for Canadians at the moment.

2.2 Practical Implications

Water audits provide a detailed analysis of a facility's water use, allowing opportunities for stakeholders to identify areas of concern and improvement. Addressing these areas can cut stakeholders expenses by reducing water use and its associated costs. Water audits are the essential first step towards understanding how facilities use their water and what can be done to improve it. Our objective and overall goal is to implement a water audit on Sexton campus in order to provide an assessment of the total water that is squandered in quantitative terms. In addition, there will be secondary research conducted with a survey in order to tie behavioural norms of either facility staff and/or students. The survey will address the behavioural aspect of water conservation because technology must be used properly by humans in order to use just enough water as is required.

The practical implications for Dalhousie University to perform water audits are endless. Audits can determine the main areas of water usage, the quality of the hardware, and provide ideas and hopefully monetary incentives to repair or replace existing infrastructure. A water audit can lead to a potential savings report that is used to show executives where savings can be made by implementing more environmentally friendly

Jennifer Organ 13-4-12 7:02 PM

Comment: What other rationale might there be? Is there anything specific to the university level, for example? Are there any gaps in this topic that exists in the literature and that this study can contribute to?

Jennifer Organ 13-4-12 7:02 PM

Comment: Not sure how this relates to your research question?

Jennifer Organ 13-4-12 7:02 PM

Comment: References required throughout

Jennifer Organ 13-4-12 7:02 PM

Comment: Are you assessing total water waste or just for specific taps? Be specific.

Unknown

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Jennifer Organ 13-4-12 7:02 PM

Comment: What will the implications of this research be?

Jennifer Organ 13-4-12 7:02 PM

Comment: References please!

Jennifer Organ 13-4-12 7:02 PM

Comment: Better articulate what you mean

technology. Though this is out of the scope of our project, our project could be used as a benchmark for a potential savings report to be made (source it K-dawg).

References required. Remember that implications refer to specific implications of your research, not water audits in general.

2.3 Literature Review

The purpose of this research project is to increase our knowledge of water audits and why they are important tools for finding water inefficiencies. Due to the multi-dimensional characteristics of this project, we conducted literature reviews for both the qualitative and quantitative research questions.

Qualitative

“Are Canadian Universities taking Sustainability seriously” by D. Rosenbloom describes a qualitative approach for dealing with sustainability and water conservation (2010). This article includes information on social aspects dealing with sustainability and helps understand our demographic of students and faculty. It shows the advantages of using tools such as water audits, energy audits, and waste audits to help retrofit/cost saving opportunities. The article really questions whether universities are doing enough on promoting sustainability considering they are supposed to be creating the leaders of tomorrow. An article by Billy Comeau about Camila Das Gupta and her challenge of creating a more sustainable planet will also be used to create survey questions on water conservation and empowerment for environmental responsibility and stewardship (2010).

“Does Water Context Influence Behavior and Attitudes to Water Conservation?” by M. Gilbertson et al. discusses water conservation attitudes and behaviors in two different communities in Australia (2011). What they assessed/researched is peoples’ attitudes towards water conservation and their actual participation in the water conservation initiatives in their local population. Importantly, these two communities have very different water conservation needs and therefore it is important to correlate how they behave towards water conservation initiatives and whether or not they participate in them. This is important for our water audit at Dalhousie University’s Sexton campus because it may give us insight into peoples’ social behavior to turning off taps. This article shows that there is a definite correlation between your background and your behaviour. This is a central part of our qualitative analysis because we will be asking questions that will allow us to get a better sense of people’s backgrounds and attitudes. Once we have a sense of this, we can see if these have any relation to how people act when a tap is dripping and how they view water conservation as a whole.

Quantitative

“Everyday water: Cultures in transition” by Allon & Sofoulis is important because it speaks about a project concerning domestic water use and how it affects natural resource policy and practice in Australia (2006). This will help our group gain

Jennifer Organ 13-4-12 7:02 PM

Comment: Is this your purpose? Or is the purpose to address a specific campus issue. Although you will learn a lot through this process, think moreso about the purpose of this research.

Jennifer Organ 13-4-12 7:02 PM

Comment: I think the organization of the literature review is effective, however it may be useful to actually identify the specific theme/research question that is being addressed through qualitative and quantitative research as the header as a reminder to the reader about the questions the literature speaks to.

Unknown

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Jennifer Organ 13-4-12 7:02 PM

Comment: Don't need to include how specific information will influence project tools.

Unknown

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Jennifer Organ 13-4-12 7:02 PM

Comment: Better articulation required.

knowledge and understanding of water conservation policies and practices in areas that have extreme water preservation issues because they have more experience dealing with these fragile problems compared to Canada. This will help us with our quantitative section because we will be able to compare how stiffer rules and regulations affect local institutions like universities. We can analyze how much money could be saved if Dalhousie would adopt more ambitious water conservation strategies like those in Australia even though it is not mandated to do so by the Canadian government.

Jennifer Organ 13-4-12 7:02 PM
Comment: Not sure how this links to your specific research questions and objectives. clarify

Dalhousie has released a fact sheet that deals with responsible water use (2008). This helps build our research by adding background information on current and past policies. The fact sheet goes into detail about money saved by being water efficient and also highlights some tips for conserving water in the home, community, and at work. One fact that was very interesting is that 40% of all toilets at Dalhousie leak. These facts sheets will be integral when we need to suggest improvements that need to be made after we analyze our results.

Another resource that we plan to use is a past project called “Dalplex Water Audit” by Richardson-Prager et al (2004). This resource will be used as a template and reference model. This resource goes into depth on descriptions of the assessment, interview process, and research and cost. Because the audit took place on the Dalhousie campus, there is a lot that we can take from the study and we also have first hand knowledge of the places described. Another similar resource is an article on Virginia Commonwealth University’s (VCU) attempt at a new water management plan (Allison, 2011). As universities undoubtedly have a large effect on the water usage in their surrounding area, it is important that water is being managed correctly. This is especially true of Dalhousie University, a large university that has a large residual effect on the surrounding Halifax Regional Municipality. VCU also evaluates all of their water inefficiencies on campus. While we are only going to evaluate leaking faucets, this study may be an insight into other water inefficiencies may be present on Dalhousie’s campus (Allison, 2011). These water inefficiencies are then met with potential fixes, which is something we also hope to achieve with our water audit.

Jennifer Organ 13-4-12 7:02 PM
Comment: Great!

2.4 Anticipated Outcomes

The first anticipated outcome from our water audit is that each building on Sexton campus will provide different levels of water efficiency. Sexton campus houses Dalhousie’s engineering, architecture, and planning facilities as well as the Gerard Hall residence. It was formerly known as the Technical University of Nova Scotia (TUNS) before it merged with Dalhousie University in 1997. The campus has been active part of the Halifax’s downtown scene since the opening of TUNS on the 25th of April, 1907. The majority of the buildings that we plan on conducting our water audit on will have been built between the late 1960’s to the early 1990’s. This time gap will mean that each building might vary on water efficiency due to the modernization of the water distribution station and reservoir installed in the facility during the time of its construction. However, there is a possibility that all of the buildings are maintained on level scale thus having similar water usage efficiency.

Jennifer Organ 13-4-12 7:02 PM
Comment: Define acronym when you first introduce Virginia Commonwealth University - see above

Unknown
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Unknown
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Jennifer Organ 13-4-12 7:02 PM
Comment: Some of this information is important for background information with regards to your case. Anticipated outcomes is not what you think your results will indicate, but moreso about how you think your research will influence future research, the university itself (what role will this information play in informing the university/future research)

Our second anticipated outcome will be that Gerard Hall will provide the greatest inefficiency zones on the Sexton Campus. Since Gerard Hall is a residence for mostly first-year students, it will be classified as a high-traffic area at all times. This means high-usage of water facilities. Bathrooms are used multiple times within hourly spans in addition to the regular use of cafeteria, kitchen and laundry appliances. This will likely make Gerard Hall the building with the highest water usage, unless there is a building that houses water experiments or something that is not public knowledge. Also, the literature review shows that students are less likely to be as responsible about the environment due to behavioural tendencies like long showers that stem from self-centered attitudes. This is just an estimated anticipation since it is based on social behavior and not the mechanics of the building. Since the water is used so frequently, it creates the highest opportunity of possible behavioural, qualitative water waste. Students are often under time constraints and this creates possible lethargic attitudes towards water conservation.

3. Research Methods

We intend to gather quantitative and qualitative data about water usage on Dalhousie University's Sexton Campus. We will discover information on water usage and habits of the student population in terms of water conservation on Sexton Campus. For our quantitative aspect, we will look at all taps on Sexton Campus and record the amount of litres per year being wasted in drips from each tap. Moreover, we will record the type of aerator on each sink as well as each sink model. For the qualitative aspect, we will hand out intercept surveys to willing participants on Sexton Campus. This will allow us to gather information concerning student and staff perspectives on the importance of water usage and water conservation.

We will use all gathered quantitative and qualitative information to discover the most efficient water systems for Sexton Campus while also locating areas and taps that need to be improved. We would also like to utilize this information to implement social and or physical (such as aerators and specific sink models) frameworks on Sexton Campus concerning water conservation. We will gather the quantitative information from Sexton Campus' public sinks/restrooms, during our water audit. We will also gather qualitative information through our intercept surveys to Sexton Campus student and staff population.

We will analyze the results of the water audit and calculate how much water is wasted in liters per year for every sink, every building, and the campus as a whole. We will also connect types of aerators and models of sinks to the leaks, to discover if there is any specific correlation. We also want to connect common themes through the questions we place in the surveys, for example whether or not certain types of people are more or less likely to act on a leaking tap by turning it off or contacting the appropriate parties to fix the situation.

For the purpose of gaining unbiased research to help answer our group's qualitative research question, we thought it was best to work with an intercept survey. As a group we feel that an intercept survey is the best tool for answering the questions above because they are cost-effective, highly efficient, personal, and allow us to get on-sight feedback that can allow for quick changes and flexibility. Two key characteristics that made intercept surveys appealing to us are on-sight feedback and how personal you can allow the survey to be. By having on sight feedback, we are able to explain our questions and ensure that they understand the meaning. Instead of sending email surveys and or mail that can easily be rejected, subjects are found to accept more when a person is standing in front of them (Spencer, 2008). Because of these benefits, our group feels that it will be the most effective tool when answering our qualitative question. Also, we can ensure that the population stays proportional meaning that the sample is in our control and not limited to chance.

Jennifer Organ 13-4-12 7:02 PM

Comment: Overall, more detail and thought is required for this section

Unknown

Deleted: information concerning

Jennifer Organ 13-4-12 7:02 PM

Comment: Have you thought about access to all rooms that have taps? Is this possible?

Jennifer Organ 13-4-12 7:02 PM

Comment: Reference any appendices you have for this. (water audit sheet?) More information required about the research materials you will use to record and collect this information. Remember that data collection protocol in this proposal should be easily followed by anyone (stab by stab guide).

Jennifer Organ 13-4-12 7:02 PM

Comment: See above comment re: more details required.

Jennifer Organ 13-4-12 7:02 PM

Comment: Is locating areas and taps that need to be improved separate from your primary data analysis? Remember to only focus on what you research questions are asking to avoid distractions and making your scope too large.

Jennifer Organ 13-4-12 7:02 PM

Comment: When you are discussing ways that you will 'use' your data ,you are speaking to data analysis. How will you analyse the data you collected through the intercept surveys and the water audit? Be specific and reference where required.

Jennifer Organ 13-4-12 7:02 PM

Comment: Okay, I now see that the following paragraph attempts to do this. I suggest deleting the second paragraph in this section as it is repetitive. However, more detail is still required in the following paragraph that speaks to data analysis and cite references that support different types of analysis.

Jennifer Organ 13-4-12 7:02 PM

Comment: You need to describe why intercept surveys are effective based on scholarly literature, not based on your own opinion of why this is the most effective tool.

Jennifer Organ 13-4-12 7:02 PM

Comment: Good, this is what you should be doing throughout.

Jennifer Organ 13-4-12 7:02 PM

Comment: What do you mean by proportional?

4. Deliverables

For the purpose of this proposal, we plan to turn in a literature review, intercept survey, final project report/ analysis, and our water audit. Our literature review will provide the reader with background knowledge and description of principles and areas of strength and weakness from other scholarly published material. Along with a literature review we also plan to turn in a copy of our intercept survey. We plan on trying to correlate environmental stewardship with students and faculty knowledge about water conservation. We will have correlation graphs to certain questions to hopefully uncover why people behave the way they do towards water conservation. Following our survey, our group plans on also turning in our results from the water audit on Sexton Campus. The results will show the number of litres per day wasted by leaky faucets as well as the connections between aerator types and sink model. Finally we plan hand in a final copy report/ analysis of our results and recommendations that demonstrate catalytic validity in hopes that Dalhousie will consider our recommendations.

Jennifer Organ 13-4-12 7:02 PM

Comment: This speaks more to what deliverables generally speak to (compared to the earlier portion of this paragraph). Project deliverables are asking what it is that you will produce from the research results and how you will share this information. More focus and energy should be placed on this section to better articulate and explain these deliverables.

5. Schedule

Table 1: Project schedule

Due Date	Goal	Implementation Steps
February 18, 2013	Rough Draft of Preliminary Proposal	<ul style="list-style-type: none"> • Each member of our group has a rough draft of their assigned portion of the preliminary research. Does not have to be 2 pages but enough to give Paul some material to analyze and criticize. • Finalize research question for both of the qualitative and quantitative portions of our project.
February 22, 2013	Preliminary Proposal	<ul style="list-style-type: none"> • Complete Proposal
February 25, 2013	Research Ethics Application	<ul style="list-style-type: none"> • Create a short survey that will analyze water usage on Sexton campus • Seek approval by the internal College of sustainability ethics board
March 4, 2013	Water Audit Testing	<ul style="list-style-type: none"> • Walk around Sexton campus, main lobby floor 1. Asking people to participate in survey
March 15, 2013	Conduct Survey	<ul style="list-style-type: none"> • If approved conduct the survey during this week
March 19, 2013	Meet with Project Advisor	<ul style="list-style-type: none"> • Set up a meeting with our Project advisor for a check in to see how our project is developing • Indicate any problems • Have any question our group members have answered
March 20, 2013	Literature Review	<ul style="list-style-type: none"> • A final and formal copy of our literature will be completed
March 26, 2013	Deliverables	<ul style="list-style-type: none"> • Group meeting to go over our remaining deliverables and delegate roles for completing our deliverables
March 29, 2013	Finalize Presentation	<ul style="list-style-type: none"> • As a group we will delegate work and presentation roles
April 2, 2013	Pecha Kucha Presentation	<ul style="list-style-type: none"> • Final presentation complete • Each member will present their delegated
April 12, 2013	Final Project Report	<ul style="list-style-type: none"> • A final report will be completed including our final data and results of the

		water audit
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6. Budget

Expense	Cost
Printing Surveys (approx. 100 sheets)	0.18 cents/ Sheet, 100 sheets = 18.00\$

The budget for our project will not require many things other than printing costs of our surveys. We are estimating printing approximately 100 surveys double sided and this will come to 18.00 dollars.

7. Conclusion and Expected Outcomes

As students of the college of sustainability, and more specifically members of the SUST 3502 Campus as a Living Lab class, we aspire to provide an in depth analysis and evaluation of the water facilities on Sexton campus as well as interpret students and building staff members thoughts and feelings towards water conservation and preservation. Our group strives to develop an understanding of the level of awareness students and staff members of Sexton campus have on the topic of water conservation and prevention. While the focus of our project is primarily analyzing the quantitative and qualitative aspects of water conservation projects, we will also use our audit results to contribute to our understanding of the water facilities on Sexton campus to analyze whether or not these facilities are sustainable and what may or may not need updates. Our group is determined to explore water facilities on Sexton campus in hopes of obtaining results that pertain to our quantitative research question. We are enthusiastic about our surveys contributing to our qualitative research question. Through this project our group will be able to analyze data, interpret surveys, and reflect on the results of a water audit, which will contribute to our knowledge of students and staff awareness of water conservation and preservation. Hopefully our project will demonstrate catalytic validity and make Dalhousie executives consider our recommendations and potentially implement them.

Jennifer Organ 13-4-12 7:02 PM

Comment: I think you need to refine what your project goals are throughout this proposal. Stay focused on your research questions.

8. Appendices

8.1 Ethics Application

**ENVIRONMENTAL SCIENCE PROGRAM
FACULTY OF SCIENCE
DALHOUSIE UNIVERSITY
(version 2010)**

**APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS
UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

GENERAL INFORMATION

1. Title of Project: Water Audit Sexton Campus

2. Faculty Supervisor(s): Tarah Wright _____ **Department:** Sustainability **e-mail:**
Tara.Wright@Dal.ca paulosylvestre@gmail.com **ph:** 902-494-3683

Unknown

Deleted: and/or Paul Sylvestre

3. Student Investigator(s): Mary-Kate Doyle, Kieran Hooey, Ciara Gallagher, Nick Bertrand, Sebastien Anderson **Department :** Sustainability **e-mail:** mkodoyle@gmail.com
ph: 902-999-3083

4. Level of Project: Non-thesis Course Project [] Undergraduate [x] Graduate []
Specify course and number: 3502 ENVS/SUST Campus as a Living Lab

5. a. Indicate the anticipated commencement date for this project: March 15, 2013
b. Indicate the anticipated completion date for this project: March 29, 2013

SUMMARY OF PROPOSED RESEARCH

2. Purpose and Rationale for Proposed Research: *Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated*

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The research questions to be investigated include both qualitative and quantitative aspects. They are: How much water is being wasted in liters (total), and where are most of these inefficiencies stemming from on Sexton Campus? What role do the staff and students play in the water inefficiencies on Sexton Campus? The purpose of this project is to identify any water inefficiencies in taps in public bathrooms and sinks on Sexton Campus, and their connection to the students and

staff on the campus as well as their connection to the types of aerators on these sinks.

2. Methodology/Procedures

a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study.

- Survey(s) or questionnaire(s) (mail-back)
- Survey(s) or questionnaire(s) (in person)
- Computer-administered task(s) or survey(s)]
- Interview(s) (in person)
- Interview(s) (by telephone)
- Focus group(s)
- Audio taping
- Videotaping
- Analysis of secondary data (no involvement with human participants)
- Unobtrusive observations
- Other, specify _____

Jennifer Organ 13-4-12 7:02 PM

Comment: Interview?

b. Provide a brief, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, the use of a flow chart is recommended.

- Create survey
- Create script
- Approach students or staff on Sexton Campus
- Survey willing participants
- Analyze results

Jennifer Organ 13-4-12 7:02 PM

Comment: Include more details for each of these components.

3. Participants Involved in the Study: Indicate who will be recruited as potential participants in this study.

Dalhousie Participants:

- Undergraduate students
- Graduate students
- Faculty and/or staff

Non-Dal Participants:

- Adolescents
- Adults
- Seniors
- Vulnerable population* (e.g. Nursing Homes, Correctional Facilities)

Jennifer Organ 13-4-12 7:02 PM

Comment: What about the interview?

*Applicant will be required to submit ethics application to appropriate Dalhousie Research Ethics Board

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited,

provide a justification for this.

The people we are looking to take our survey involve those employed on Sexton Campus as well as students who study on Sexton Campus. This will include males and females of any gender, and a large age range due to the possibilities of younger and older students and staff.

c. How many participants are expected to be involved in this study? _____

Jennifer Organ 13-4-12 7:02 PM

Comment: More thought and detail required.

4. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

- Dalhousie University undergraduate and/or graduate classes
- Other Dalhousie sources (specify) _____
- Local School Boards*
- Halifax Community
- Agencies
- Businesses, Industries, Professions
- Health care settings*
- Other, specify (e.g. mailing lists) Intercept survey on Sexton Campus

*Applicant may also require ethics approval from relevant authority, e.g. school board, hospital administration, etc.

Jennifer Organ 13-4-12 7:02 PM

Comment: ? This should be something you speak to in your proposal too – how many people are you trying to recruit?

Jennifer Organ 13-4-12 7:02 PM

Comment: Include interviews too

b. Identify who will recruit potential participants and describe the recruitment process.

Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts in the appendices section.

-planned script / sign

Jennifer Organ 13-4-12 7:02 PM

Comment: ?

5. Compensation of Participants: Will participants receive compensation (financial or otherwise) for participation?

Yes No If Yes, provide details:

6. Feedback to Participants

Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement. Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.

There will be no feedback letter due to the anonymity of this intercept survey.

POTENTIAL BENEFITS FROM THE STUDY

2. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

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There are no direct benefits to the participants from their involvement in the survey. However, it may further the knowledge of water inefficiencies on Sexton Campus concerning dripping taps. This will allow us to find how much water is being wasted, and potentially how to fix these issues. Participants will enjoy a more water-conscious Sexton Campus.

2. Identify and describe any known or anticipated benefits to society from this study.

There are no known benefits, however society may also enjoy a more water conscious Sexton Campus that will hopefully translate into a more water conscious Halifax Regional Municipality. ([what about economic benefits?](#))

POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

5. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors and burdens.
- No known or anticipated risks Explain why no risks are anticipated: There are no mentally taxing questions on the survey, and it is anonymous.
- Minimal risk * Description of risks:
- Greater than minimal risk** Description of risks:

* This is the level of risk associated with everyday life. ** This level of risk will require ethics review by appropriate Dalhousie Research Ethics Board

6. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

There are none because there are no known or anticipated risks.

INFORMED CONSENT PROCESS

Refer to: <http://pre.ethics.gc.ca/english/policystatement/section2.cfm>;

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

- Information letter with written consent form; provide a copy
- Information letter with verbal consent; provide a copy
- Information/cover letter; provide a copy
- Other (specify) Willing participants will be approached with an information script about the survey and they will then verbally consent to participating

2. If written consent cannot be obtained from the potential participants, provide a justification.

ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Explain the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

No personal names will be used throughout our survey or study, the participants will

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Jennifer Organ 13-4-12 7:02 PM
Comment: interviews?

remain anonymous throughout the entire process.

7. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.

-The surveys will be kept in a locked drawer one of the facilitator's houses, until they are shredded. However they will be transferred to a password protected computer

Jennifer Organ 13-4-12 7:02 PM
 Comment: Again, speak to interviews too
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8. Indicate how long the data will be securely stored as well as the storage location over the duration of the study. Also indicate the method to be used for final disposition of the data.

- Paper Records
 - Confidential shredding after March 29
 - Data will be retained until completion of specific course.
 - Audio/Video Recordings
 - Erasing of audio/video tapes after _____
 - Data will be retained until completion of specific course.
 - Electronic
 - Erasing of electronic data after Five years on a password protected computer
 - Data will be retained until completion of specific course.
 - Other _____
- (Provide details on type, retention period and final disposition, if applicable)

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Specify storage location: Under lock and key at a facilitator's house, then to be kept on a password protected computer.

Appendices: ATTACHMENTS Please check below all appendices that are attached as part of your application package:

- Recruitment Materials:** A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s).** Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s).** Used in studies involving surveys or questionnaires.
- Materials:** A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.

SIGNATURES OF RESEARCHERS _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date _____

Signature of Student Investigator(s) Date

FOR ENVIRONMENTAL SCIENCE PROGRAM USE ONLY: Ethics proposal been checked for eligibility according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans

_____ Signature Date

_____ Signature Date

8.2 Intercept Survey

Water Audit Sexton Campus Intercept Survey

1. Are you a student, faculty or staff member at Dalhousie University? Circle one

Staff / Student / Faculty

2. If you are a student, what degree are you pursuing?

Check for not applicable

3. If you are a staff or faculty member, what department do you work in?

Check for not applicable

4. How many days a week are you on Sexton Campus? Circle one

1-2 3-4 5 6-7

5. On a scale of 1-5, one being the lowest and 5 being highest, how would you rate your environmental stewardship (responsibility to care for the environment) on Sexton Campus?

1 2 3 4 5

6. Have you ever noticed a dripping tap on Sexton Campus? Circle one.

Yes / No

6a. If yes, where have you noticed a dripping faucet (Building, Floor)?

6b. When you noticed the dripping faucet, did you try to fix it yourself?

Jennifer Organ 13-4-12 7:02 PM

Comment: List with an identifier so it will be easier to enter data in spreadsheet

Jennifer Organ 13-4-12 7:02 PM

Comment: Do you see any issues with this scale?

Unknown

Deleted: 1: no stewardship at all . 5: high stewardship

Jennifer Organ 13-4-12 7:02 PM

Comment: This can come across as personal. What is the value of this question to your overall project? If it hold value, perhaps there is another way of asking this or placing it near the end when people are warmed up a bit.

Jennifer Organ 13-4-12 7:02 PM

Comment: List:

a. Yes
n. No

Jennifer Organ 13-4-12 7:02 PM

Comment: might also be worth listing these with an obvious space to write the response for consistency among people conducting surveys if floor and building are important to include in data.

Jennifer Organ 13-4-12 7:02 PM

Comment: What do you mean by fix it? Try turning it off? Some people might think you are asking if they got out their tools etc ©

Yes / No

6c. would you know who to notify about the problem? Circle one.

Unknown
Deleted: When you notice a dripping faucet and you cannot fix it yourself,

Yes / No

7. On a scale of 1-5, what is the likelihood you would notify someone about a dripping tap? 1: not likely, 5: very likely

1 2 3 4 5

Unknown
Deleted: at all

8. On a scale of 1-5, how important to you is water conservation on Sexton Campus? 1: not important 5: very important.

1 2 3 4 5

Unknown
Deleted: would definitely call someone

8a. why?

Unknown
Deleted: What is your reasoning for choosing this number

9. What do you feel it would take to make people on Sexton Campus more concerned about water conservation?

Jennifer Organ 13-4-12 7:02 PM
Comment: It's also nice to end with thanking participants for their time.

9. References

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11.3 Copy of Aggregate Data: Water Audit

Gerard	Aerators												
Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model
KG							1	1	1		5420		
BWG				1				1	1		6570		M
BC1			1					0					M
BC1			1					0					M
BC2			1					0					5
BC2	1							0					M
K2					1			1		1	6570		M
BC3			1					0					5
BC3			1					0					5
BC4			1					0					5
BC4			1					0					M
BC5	1							0					M
BC5	1							1	1		6570		M
BC6			1					0					M
BC6			1					0					M
BC7			1					0					5
BC7					1			0					5
K7					1			0					M
BC8			1					0					5
BC8			1					0					5
K8					1			0					M
BC9			1					0					5
BC9			1					0					5
K9					1			0					M
BC10			1					0					5
BC10			1					1	1		6570		5
K10				1				0					M
BC11	1							0				SPRAYS AT YOU	M
BC11			1					0					5
K11					1			0					M
BC12	1							0					M
BC12			1					0					5
K12							1	1	1		6570		
Medjuck						Medjuck							Medjuck
						Aerators							

Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model
BWG					1			0					M
BWG					1			1	1		20075		M
BMG					1			0					M
BMG					1			0					5
BMG							1	0					
BW1					1			0					M
BW1					1			0					M
BM1					1			0					M
BM1					1			0					5
BC1					1			0					M
K1							1	1	1		6570		
K1					1			0					M
K1					1			0					M
BC2					1			0					M
BC2					1			0					5
K2							1	1	1		13505		
<hr/> <hr/>													
MacDonald	A												
Aerators													
Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model
BW2					1			0					M
BW2				1				0					M
BC3	1							1		1	6570		M
<hr/> <hr/>													
MacDonald	B												
Aerators													
Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model
BW1							1	0					
BW1							1	0					
BW1							1	0					
BM1					1			0					M
BM1					1			0					M

BM1					1			0						M
BM2-1					1			0						M
BM2-2					1			0						M
BM2-3								1	1	1		13505		
BM2-4								1	1	1		13505		
BM2-5								1	1	1		6570		
BM2-6			1					0						M
BM2-7								1	1	1		6570		
BM2-8					1			0						M
BM3					1			0						M
BM3					1			1	1			101105	LOOSE KNOB	M
BM3					1			0						M
BM3								1	1	1		13505		
BM3								1	1	1		6570		
BM3								1	1	1		13505		
BM3								1	1	1		13505		
BM3					1			0						M
<hr/>														
<hr/>														
MacDonald	N													
Aerators														
Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model	
WB1				1				1	1			67525	HARD TO TURN	M
MB1					1			0						M
MB1							1	1	1			13505	HAS AERATOR-NO MARKINGS	
WB3					1			0						M
WB3					1			0						M
MB1-2					1			0						M
MB1-2					1			0						M
<hr/>														
<hr/>														
MacDonald	Q													
Aerators														
Faucet	0.5 gpm (1.9 lpm)	1 gpm (3.8 lpm)	1.5 gpm (5.7 lpm)	(7.6 lpm)	2.2 gpm (8.36 lpm)	3.0 gpm (11.3 lpm)	No aerator (lpm)	Drip	mechanical	behavioural	LPY (rain gauge)	Notes	Model	
MB1							1	0						
MB2					1			1	1			13505		M

MB2					1			0					M
WB4							1	0				SPRAYING WATER	
WB5							1	0					

11.4 Copy of Aggregate Data: Intercept Survey

Water Audit Sexton Campus Intercept Survey

Q1.	Q2.	Q3.	Q4.	Q5.
2	Community Design		2	4
2	Community Design		2	4
2	Community Design		2	4
2	Arts		2	4
1		Administration	3	2
2	Engineering		1	4
2	Engineering		4	3
2	Arts		1	5
2	Engineering		4	4
2	masters		2	3
2	Commerce		1	3
2	management		3	4
2	Architecture		3	2
2	Engineering		3	3
2	Arts		1	3
2	Engineering		2	3
3		Engineer	2	3
2	Engineering		4	4
1		Custodial	3	1
3		Engineer	3	4
2	Engineering		4	4
2	Engineering		1	3
2	Economics		3	2
2	Engineering		4	4
2	Engineering		4	4
2	Engineering		4	4
2	Engineering		4	5
2		Aquatics	3	3
2	Engineering		3	3

2	Sciences		4	4
2	Community Design		4	3
1		Security	4	3
3		Architecture	2	4
2	Architecture		3	4
2	management		1	2
2	Arts		1	2
1		Custodial	4	3
2	Kinesiology		3	1
3		Environmental Science	4	3
2	Engineering			3
1		Athletics	2	4
2	Kinesiology		1	5
1		security	4	3
2	Engineering		4	2
3		Engineer	3	3
2	Engineering		3	3
3		Engineer	3	4
3		Engineer	3	4
2	Physics		4	4
1	Engineering		4	3
2	Engineering		2	2
2	Engineering		4	5
2	Engineering		1	3
2	Engineering		1	2
2	Architecture		4	3
2	Architecture		4	4
2	masters		4	4
2	Environmental Design		4	3
2	Architecture		4	3
2	Architecture		4	3
2	masters		4	3
2	masters		4	4
1		Architect	4	3
2	Architecture		4	3
2	Architecture		4	2
2	masters		4	1
3		Engineer	3	5
2	Architecture		2	3
2	Arts		2	1
2	Community Design		4	3
2	Community Design		2	2
2	Architecture		1	2

3	Engineer	4	4
1	Custodial	3	3
1	Community Designer	2	4
2	Engineering	4	3

56= Students	19= Faculty/Staff	33=4	5=5
22= Engineers	7=Engineers	16=3	
10= Architecture	2=Architect	14=2	
6=Community Design	3=Custdoal	11=1	
5= Masters	1=Community Designer		
5=Arts	1=aquatics		
2=Kinesology	2=Security		
1=Commerce	1=Environmental Scientist		
1=Physics	1=Administration		
1=Sciencies			
1=Econmoics			
1=Environmental Design			
1=Management			

Q6.	Q6A.	Q6B.	Q6C.	Q7.	Q8.
2	MacDonald Building 1st floor	2	2	1	3
2		2	2	1	3
2		2	2	1	3
2		2	2	2	4
1	Macdonald B building	1	2	2	3
2		1	2	1	4
1	Macdonald B building	1	1	3	4
1		1	2	3	3
2		2	2	5	5
1	Library mens washroom	2	2	1	1
2		1	2	3	4
1	Troom bar during the day	2	1	4	5
2		1	2	3	3
1		1	2	2	4
2		2	1	2	3
1	GH Murray Building 1st floor	2	2	1	3
1	Macdonald Building B 1st floor	1	1	4	3
2		1	1	1	5
1	Macdonald B	1	1	2	1
1	Macdonald B	1	1	4	4
2		2	2	5	4
1	Gerard	1	1	1	2
2		2	2	1	2
1	Macdonald B building	1	2	3	4

1	Gerard 12th floor	1	2	2	3
1	Gerard 8th floor	1	2	1	3
1	Gerard 8th floor	1	1	3	3
2		1	2	2	3
2		1	2	1	3
1	Gerard 8th floor	1	1	4	5
2		1	2	2	4
1	Macdonald B building	1	1	4	3
1	Medjuk 2nd floor	1	1	5	4
1	Medjuk kitchen	1	2	3	4
1	Gerard 10th floor	2	1	1	1
1	Macdonald B	2	1	5	5
1	Gerard 8th floor	1	1	5	4
1	MacDonald B	1	2	1	5
1	MacDonald B	1	2	3	3
1	MacDonald Gym Change rooms	1	2	4	4
1	Troom bar during the day	2	2	1	4
2		1	2	1	4
2	Design Commons	1	2	2	3
1	Gerard 8th floor	2	2	1	3
2	MacDonald Q Buidling	1	2	1	4
1	MacDonald N Buidling	1	2	3	5
2		1	1	3	3
2		1	1	3	4
4	Medjuk 2nd floor	1	2	1	3
2		1	2	1	3
2		2	2	3	2
1		1	2	2	5
2		1	2	1	3
2		1	2	2	2
2		1	2	2	3
1	Medjuk 1st floor	1	2	2	5
1	Medjuk kitchen	1	1	3	5
1	Medjuk kitchen	2	2	1	3
1	Medjuk 2nd floor	1	2	2	3
2	Medjuk kitchen	2	2	1	3
1		2	2	3	3
2		1	1	3	4
2		1	2	2	3
2		2	2	4	4
2		1	1	3	2
1	Medjuk kitchen	1	2	1	5
2		1	2	5	5

1	Macdonald B 1st Floor	2	1	5	3
1	Gerard 8th floor	2	2	1	1
1	MacDonald B Buidling	1	1	5	5
2		2	2	3	3
2		1	1	4	4
2		1	1	5	5
2	Macdonald B building	1	1	5	3
2		1	2	5	5
2		2	1	3	1

Q8A.

Lack of motivation

lack of interest

lack of interest

interest in topic

N/A

important water conservation

reliable resource/cost money

no control over water conservation

reduce waste and cost = important

no problem in local area = no issue

important but not on sexton enough

reducing water is the first step for awareness

important but will not go out of the way conserve water

understanding the scarcity of water and consequences

no action but I care

education

neutral some other issues more important

Important and valuable resource

N/A

Need for survival

Environment is key factor in becoming sustainable

lack of interest

not interested due to personal advantages and disadvantages

Personal interest in environmental issues such as water

N/A

N/A

N/A

Not a problem

Have not thought about it

Environment is important personally

N/A

Important but not as health and security

Water finite resource

finite resource for other countries and populations
 Abundance of water (Atlantic ocean)
 Have personal relationship with environment
 care for work
 Need water for survival
 Not informed enough
 Do not like seeing things going to waste
 personally important to conserve water
 Lucky to have a lot of fresh water/ should conserve it
 important but do not see the the huge issue with wasting water on campus
 Important for human life and well being for survival
 N/A
 personally environmentally conscious
 Knows the importance but not high on his personal priority list
 any waste that can be avoided should--> efficiency
 in the middle not too important but still there
 important but not as important as other issues
 too busy --> do not care at all
 universities should be setting as examples
 important but who is responsible
 Really busy
 other issues that deal with sust--> paper/material, heat/cooling waste
 water finite resource and very important
 fundamental to environmental sustainability
 neutral about the issue
 ignorance
 very important but in case of overall picture very small

be more environmentally conscious

did not know there was a problem
 valuable resource
 environment is important for future progress
 no self impact
 bigger problems in the world
 finite resource for other countries and populations
 more important things to worry about but water still important
 water= everything
 finite resource for other countries and populations
 not enough information about topic
 water =life
 ain't got time for that

Q9

More education

More awareness

More awareness

More awareness

n/a

Incentives

More awareness

More awareness

More awareness

more issues to deal with on campus = facilities upgrade= gym

signs in bathrooms, fun facts, and more awareness

more awareness= education

more awareness

more awareness and apply legislation/penalties

more awareness= showing water wastage display

more awareness upgrade pipes

limit amount of water access

taxation incentives and T Room water conservation events

N/A

limited access to water

more education and awareness

not enough education and awareness

drought--> natural disasters

education more awareness and taxations incentives

N/A

N/A

N/A

more awareness

education more awareness and taxations incentives

more focus in education (in programs @ Dal)

more awareness

education more awareness and taxations incentives

education more awareness and taxation incentives

education more awareness and taxation incentives

Turn off water for a day=event

education more awareness and taxation incentives

education more awareness and taxation incentives

education more awareness and taxation incentives

education more awareness and taxation incentives

education more awareness and taxation incentives

education more awareness and taxation incentives

more education and awareness and taxation incentives
 more education and awareness and taxation incentives
 interesting water fountains at the killlam
 faculty and upper year students to set as an example--> they make a more friendly environment
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 signs above taps = more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 Awareness
 Does not know
 more awareness, education and taxation incentives
 social marketing campaign
 more awareness, education and taxation incentives
 more awareness, education and taxation incentives
 education

more awareness, education and taxation incentives

more awareness, education and taxation incentives
 more awareness, education and taxation incentives
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 more awareness, education and taxation incentives

11.5 Sampling Instruments Used

Script:

Facilitator: Hello how are you? My name is _____ and I am student at Dalhousie University. Would you be available to complete a survey concerning water usage on Sexton Campus? It is open to anybody! The Survey is entirely undisclosed which means

we do not need to know your name. If you do not feel comfortable with any of the questions feel free to skip them. I will be here to answer any questions you have!

Survey:

Water Audit Sexton Campus Intercept Survey

10. Are you a student, faculty or staff member at Dalhousie University? Circle one

Staff / Student / Faculty

11. If you are a student, what degree are you pursuing?

Check for not applicable

12. If you are a staff or faculty member, what department do you work in?

Check for not applicable

13. How many days a week are you on Sexton Campus? Circle one

1-2 3-4 5 6-7

14. On a scale of 1-5, one being the lowest and 5 being highest, how would you rate your environmental stewardship (responsibility to care for the environment) on Sexton Campus?

1 2 3 4 5

15. Have you ever noticed a dripping tap on Sexton Campus? Circle one.

Yes / No

6a. If yes, where have you noticed a dripping faucet (Building, Floor)?

6b. When you noticed the dripping faucet, did you try to make it stop dripping yourself?

Yes / No

6c. When you notice a dripping faucet and you cannot fix it yourself, would you know who to notify about the problem? Circle one.

Yes / No

16. On a scale of 1-5, what is the likelihood you would notify someone about a dripping tap? 1: not likely 5: would definitely call someone

1 2 3 4 5

17. On a scale of 1-5, how important to you is water conservation on Sexton Campus?
1: not important 5: very important.

1 2 3 4 5

8a. What is your reasoning for choosing this number?

18. What do you feel it would take to make people on Sexton Campus more concerned about water conservation?

Thank you for taking the time to participate in this survey!