

WATER USE AND CONSERVATION AT THE UNIVERSITY OF KANSAS

Sam Gleeson
Kristen Klenow

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Abstract

This report gives a background on why the research of water use is important. Water is a limited resource, only 2.5% of all water is fresh water, and of that 2.5% only 1% of it is water available for human use. This number is subject to decrease as pollution of water continues to increase. The conservation of water is important because it is cost affective and it helps preserve the environment from which the water is taken. A general summary of current water on campus can be broken up into two major categories, Inflow and Outflow. Inflow refers to the two sources of water on campus. Water is pumped from Clinton Reservoir and the Kansas River. Water also enters campus through precipitation year-round. Outflow refers to stormwater run-off, ground water absorption, and wastewater which is treated and then discharged. Recommendations for the University to conserve water are in two categories: the first are long-term recommendations which include changing bathroom fixtures to more water efficient or even water free models, the installation of rainwater cisterns which could be used for irrigation, and changes in landscaping to use less water. Short-term and lower cost recommendations include a public awareness campaign to get students living on campus to reduce their water use, as well as another awareness campaign giving people information on reporting leaky faucets, toilets, and other water losses so they can be fixed promptly.

Key Words: campus sustainability, Conservation, KU, public involvement, Water Use

Introduction

Water covers seventy-one percent of the earth surface. Even so, water is a limited resource, Only 2.5% of the Earth's water is freshwater; of this 68.7% is in icecaps and glaciers, 30.1% is groundwater, and only 0.3% is surface water. Of all the freshwater on Earth only 1% of it is water available for human use. Water is necessary for all human life and people are using it at alarming rates (www.gov.ab.ca/env/water).

The purpose of this report is to create a comprehensive report on water use on the campus of the University of Kansas. This includes where the water comes from, where it goes, how much the University uses, and the ways in which the University can use less water. Water use and conservation have many important impacts on people as well as the world they live in. We will explore details about how water gets from our local sources, up to campus and back. We will also be going into how much water the University of Kansas uses, what it is used for, and how that use changes in different time scales.

The most important part of this report are the recommendations for the University on how to use less water. Suggestions include both long-term, costly infrastructure changes, as well as short-term little or no cost solutions to get people to reduce their water use immediately.

Contact Table

<i>name</i>	<i>title</i>	<i>department</i>	<i>email</i>	<i>contacted</i>
Kip Grosshans	Associate Director for Administration	KU Department of Student Housing	Kip@ku.edu	4-19-09
Craig Hansen	Energy Program Manager	KU Facilities Operations	Hansenc@ku.edu	2-19-09
Peg Livinggood	Landscape Architect	KU Center for Design and Construction Management	peggyl@ku.edu	3-3-09
Jeff Severin	Director	KU Center For Sustainability	Jseverin@ku.edu	2-18-09
Matt Bond	Storm Water Engineer	City Of Lawrence	mbond@ci.lawrence.ks.us	3-12-09

Background

Pollution of freshwater is becoming an issue of increasing importance. The main cause of pollution of our water begins with our storm drains. There are 7,500 storm drains in Lawrence that collect the runoff from the City. The runoff flows over all the impervious surfaces in our town and carries the “debris, soil, garbage, pet waste and hazardous wastes” that it collects into the storm drains. Many people don’t realize that the storm drains flow to the rivers, and will improperly dispose of their “yard debris, motor oil, antifreeze, fuel, pet wastes, and litter” (City of Lawrence, Kansas) by dumping it directly into the storm drain which will then contaminate the rivers. The usage of pesticides and fertilizers is also a major contributor to water pollution because they contain phosphorus and nitrogen. These nutrients promote the growth of aquatic plants, which, when they die are decomposed by microbes which, consume the oxygen in water.

If yard waste is swept into the street it can clog the storm drain while contaminating the water with bacteria, phosphorus, nitrogen, and other pollutants that can reduce oxygen in the water. The main pollutant of our water is the build-up of sediment from our yards and construction sites. The sediment can block the sunlight for aquatic plants and animals, making it difficult for them to survive. Other damaging pollutants are motor oil and antifreeze, both of which can kill aquatic life. Painting equipment rinsed near the storm drains can infiltrate the water with lead, mercury, and organic solvents and harm the environment. (City of Lawrence, Kansas)

So why is water conservation important? If we are in an area with plenty of water, why should we conserve water now? The cost of water in the City of Lawrence is \$2.92 per 1000 gallons. Reducing water use reduces the cost of water bills as well as energy bills for the energy needed to heat the water. If we are more conscious about our water and how we use it, we can save energy on the treatment of our water before and after we use it. For example, the implementation of graywater (untreated water that has

not come in contact with human waste) could be considered for use in toilets and other appliances that do not need to meet the highest standards set by the Safe Drinking Water Act. This leads to the next reason, it is illegal to pollute our waterways. Congress implemented limitations on water pollution with the “National Pollutant Discharge Elimination System (NPDES)” (Salzman, 144) in 1972 requiring any person to obtain a permit before polluting our water. With this permit, “Publicly Owned Treatment Works” are given a limit to their pollution and are also required a particular level of technology to treat the pollution before it enters the waterways.

Most importantly, water conservation preserves the environment. We use the natural waterways, reservoirs, wells, and cisterns to access our water. Being more conscious of how we affect the environment and the water we take from it, will enable the water sources to remain stable, which will, in turn, provide us with cleaner, healthier water. Our water conservation efforts could have a lasting affect on the preservation of the Wakarusa Wetlands. These wetlands are a natural resource that presently are not being used to their full potential. We could use the Wakarusa Wetlands as a drainage area for some of the city’s stormwater, this will help to detain runoff. If they were treated as a necessity to the city, we would be able to preserve the unique habitat that thrives there.

The sediments found in a wetland are full of bacteria capable of breaking down a variety of pollutants. The Clatsop Community College, located in Astoria, Oregon, uses a sewage plant called the “Marine Environmental Research and Training Station” (Wenz, 8) where they treat sewage from the College in a unique way. After breaking down most of the human waste with bacteria, they use plants living in an enclosed tank, which is essentially a manmade “wetland” to remove most of the pollutants from the water. This process runs mostly on sunlight and requires very little maintenance. Methane is the main byproduct of the process and it is used for fuel. This system has been found to be extremely affective and relatively inexpensive. The more active we are in water conservation, the less problems we will face in the future when water becomes much less plentiful as a resource.

Current Campus Water

Water comes into the campus by two means; Pumped water and precipitation. The University of Kansas gets 80% of its municipal water from the Kansas river in north Lawrence. The other 20% comes from Clinton reservoir southwest of Lawrence (City of Lawrence). Lawrence also receives an average of 39.78 inches of rain each year (*Lawrence, Kansas Weather*).

Precipitation

The water input from precipitation is free and other than what the plants soak up during the shower most of this water goes unused. Precipitation run-off is a cause of pollution because storm sewers are not treated before dumping back into the Kansas River. Small steps are being made to prevent so much run-off from making it unimpeded back to the river. KU’s campus produces a lot of run-off as well. The total area of campus

is 950 acres, 321.7 of which are impermeable surfaces. This includes the amount of area covered by buildings, streets, sidewalks, and parking lots.

Pumped water

In 2008 237,952,750 gallons of water was used by KU. At a rate of \$2.254 per 1000 gallons, this cost the University \$536,345.50. This price increases every year. For 2009 the university is paying \$2.309 per 1000 gallons. The increasing price is not controlled by the university. What is controlled however, is the amount of water used on campus (Craig Hansen and Kip Grosshans). Along with this cost of bringing water to campus, every 1000 gallons which the University sends back down the sanitary sewer system costs an additional \$4.932 (Craig Hansen). For this reason the water which does not go down the sanitary sewer, is strictly metered so that a sewer credit can be added. The uses for water which does not end up in the sewer system are irrigation which goes into the ground or the storm drains and use in evaporative coolers which goes into the atmosphere.

Of the 237,952,750 million gallons used by the University of Kansas 55% is used by main campus. 9% is used on west campus and a significant 36% is used by Housing alone.

Irrigation contributes a significant amount to the universities water bill every year. 11,961,380 gallons in 2006 were used for irrigation by facilities and operations as well as for athletics fields for baseball, softball, football and soccer. The areas irrigated most are along Jayhawk Boulevard, the chancellor's residence and athletics fields.

Irrigation is done by three methods. First is the use of pop-up sprinklers installed at a select few lawns around campus. Second is by tapping into buildings through hook ups on buildings. Lastly is by filling large tanker trucks on west campus and watering lawns and flowerbeds remotely with that (Lang).

A large portion of the KU's water use is during the summer when lawns are being irrigated and evaporative coolers are being used to cool buildings across campus. Neither of these uses contributes to sewer water costs because the water is either lost into the atmosphere or absorbed into the ground. (Hansen) The evaporative coolers are used for the larger

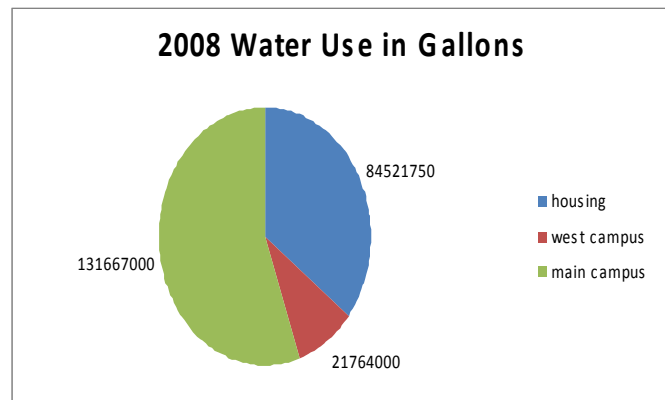


Figure: # 1 KU's water use in Gallons from 2008

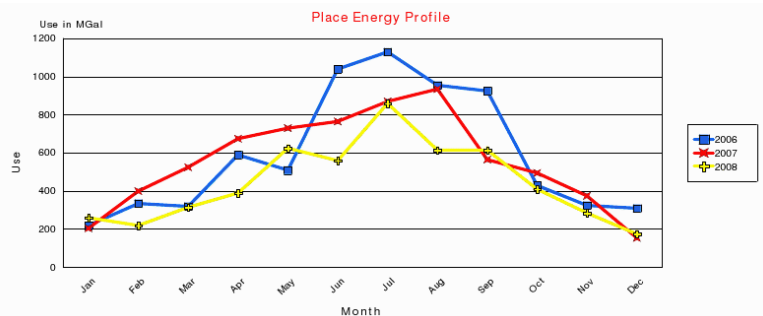


Figure # 2: Month by month fluctuations in water use at the Kansas Union for 2006-2008 (Craig Hansen)

buildings on campus. Smaller buildings are cooled by smaller air cooled units which use no water. The evaporative cooling towers are much more energy efficient though, which is why the university operates them despite the extra water use. (Hansen)

The evaporative coolers are maintained regularly by Facilities and Operations to keep operating costs low. When units are replaced or new units are installed they are replaced with the most efficient models available. A central chiller building cools Haworth, Mallot, Wescoe, Fraser, and Stauffer Flint halls along with the Dole Human Development Center. While this type of cooling system is more energy efficient than having individual units on those buildings, it is not yet been determined if this style of cooling strategy is more or less efficient when it comes to water use. (Hansen)

Current University Conservation Efforts

Although there are many ways that the University can improve upon our water conservation methods, we have already taken measures to move in the right direction. Dorm dining halls have not used trays since October 2008 and have saved ca. 80,000 gallons of water thus far. This information comes from comparing October, November, and December 2007 and 2008 water uses, with the elimination of trays being the only altered factor. Each of the irrigation systems on campus are set to run at specific times of year, or for a certain number of days in the week. They are set on timers for early in the morning to cut down on evaporation. They are also equipped with rain sensors and will shut off during rainfall. (Livingood)

When constructing the Park and Ride parking lot, the University created a detention basin to collect stormwater runoff and regulate how much water is released. Instead of using green, turf grass, which is found virtually everywhere else on campus; the Dole Institute on West Campus consists of native prairie grass. (Bengston et al, 17) These native grasses, adapted to Kansas' hot, dry summers, require considerably less water than non-native species. Also, native plants can replenish the soil and provide a significantly lower risk of flood in the area because the roots naturally adapt to the soil in which they are planted. Heavy rain flow percolates through the ground easily without uprooting the vegetation. The Prairie Acre located at the intersection of Sunnyside Drive and Sunflower Road is said to be the only unplowed surface left on the University of Kansas main campus. It has been preserved since June 1932, and though it has lost many of the native species that once inhabited the area, efforts to revitalize the lost species have been made by students and faculty over the years. (Bengston et al, 18) Currently, University landscaping uses organic fertilizers and is careful not to over-fertilize the vegetation on campus and mows lawns at a specific height to retain moisture in the soil while also using mulch, all of which conserves water and decreases sediment flow through runoff. (Bengston et al)

Student efforts from the School of Architecture and Urban Planning are working with students from the School of Engineering to put in a raingarden in the Student Recreation and Fitness Center. The raingarden will use water runoff from the roofs on campus to water the vegetation in the garden, slowing the runoff into the stormdrains. Everything planted in the garden will be native to the Lawrence, ensuring more water conservation, stabilization of the water table, and low maintenance region. They planted over 2500 native plants in the garden on Earth Day this year, April 22, 2009. Student Senate, Student Recreation Services and the Center for Sustainability are all

working together to fund the project. A research assistant for the Center for Sustainability is working with Design and Construction Management at KU to determine the possibility of composting on campus. This would reduce fertilizer use that could be potentially detrimental to our water. (Center for Sustainability)

Implementation of Potter Lake in 1911 was originally for the purpose of providing water to extinguish fires on campus. This became quickly outdated by improvements in the



Figure # 3: Potter Lake at KU (Kansas Geological Survey)

City's water supply and Potter Lake no longer had little purpose, other than aesthetics. After about ten years the quality of water in the lake came into question. A committee was formed in 1924 to study the problem. A decision was made to ban swimming in the lake and it remained fairly untouched until the 1950s when silt began collecting in the lake as a result of various construction projects atop Mount Oread. So much silt collected that the depth of the lake went

from 16 feet to a mere six feet and several discarded items that littered the bottom of the lake could be seen from the surface. The University decided to drain and dredge the lake in 1958. Several different objects including "...car bodies, tires, trash barrels, and other debris buried in the silt" (Harvey) were found after the lake was drained. After the removal of these items, a small silt-catching pond was put in on the south side of the lake, right at the bottom of the hill.

In 1968, university biologists who were studying the lake reported that pollution and decaying vegetation in the silt-collecting pond was producing methane and causing an unpleasant odor. Complaints were also made about the beer cans littering the area. Despite these problems the lake was facing, drastic measures were not taken. By the 1990s some fish began to inhabit the lake again, but even now it is still heavily polluted. It was put on the list by the Kansas Department of Health and Environment as one of 120 polluted bodies of water. KU students today have put together a group looking to improve upon the health of Potter Lake. Not much progress has been made yet, but the lake has potential to one day thrive again. (Harvey)

The City of Lawrence as a whole has also been making efforts to improve on water conservation. Stormwater engineers try to meet specific standards for the City with the projects they work on. Their main objectives are to improve the quality of water in Lawrence that has been affected by storm drainage systems, to prevent runoff that could contain contaminants from entering the storm drains, to promote recycling of used motor oil and discarding non-recyclable hazardous waste properly, to inform the public of the importance of stormwater maintenance, to make sure it is easy for everyone to obey the Federal and State rules for water use, and to make sure it is possible for the City to meet all standards set by the NPDES. In 2003 Lawrence applied for a permit and entered phase II regulations set by the NPDES. These regulations are minimum requirements that the City must perform in the promotion of pollution prevention. These would

include Public Education on stormwater pollution, public participation and involvement, illicit discharge detection and elimination, construction site runoff controls, post-construction runoff controls, and pollution prevention in municipal operations. By achieving these goals Lawrence will be setting standards for the City above those of many other cities in the U.S. (Bond). The City of Lawrence is composed primarily of students and other persons affiliated with the University of Kansas. The University could be a large contributor to achieving these high standards set by The City. If the University posed as a role model in water use for the other citizens of Lawrence, the City could make great advancements toward water conservation.

The City is also ahead of many others by trying new ways to reduce runoff and the pollution from the runoff. The City has built areas of porous concrete where the water can flow directly into the ground and eliminate runoff completely (City of Lawrence).

Lawrence farmers are also using biosolids as fertilizers and soil conditioners. Biosolids are the primarily organic solid product produced by wastewater treatment processes that can be beneficially recycled. They contain nutrients, micronutrients, and organic matter. Biosolids have also been distributed to the public to use for fertilizing lawns and gardens. The main issue faced with enforcing the usage of biosolids is public acceptance and education. (*Lawrence, Kansas Biosolids Recycling in the Midwest*)

Recommendations

Long-term

Kansas University is a very old campus. Founded in 1866 the University is undoubtedly historic in its own right. However, for water use efficiency this means that many fixtures throughout campus need updating. This is not to say that most toilets, sinks, coolers, and pipes on campus are 150 years old, but many are certainly not modern.

Upgrading Fixtures

The University throughout the years has remodeled and upgraded buildings on many occasions. These types of upgrades certainly need to continue for the University to continue limiting its water use. Currently, when any remodeling is done that would involve water fixtures (toilets, sinks, etc.) or plumbing infrastructure the replacements are modern and relatively efficient. (Hansen) For example, many of the sinks which have been recently upgraded had manually operated faucets and they were replaced with automatic faucets. This alone has little or no affect on the actual rate of flow, but it does cut out any human error in not turning of the faucet all the way or in some cases not turning the faucet off at all. Many of the faucets have also been replaced with those that have lower rates of flow. Using aerators on faucets add air into the water flow which not only maintains water pressure on lower flow faucets it also restricts the water flow by as much as two gallons per minute. (Vickers)

Toilets are also replaced when building upgrades are made. Many old toilets used up to 3.5 gallons per flush. The modern toilets which the university installs when they are

adding new facilities or remodeling old facilities are 1.6 gallons per flush. Replacing one of these old toilets with the modern kind will save 494 gallons per person per year for males and 1,482 gallons per person per year for females. At the University which has such high usage due to the number of individuals on campus these savings become very significant. (Nancarrow, Blair E., Clive Seligman and Geoffrey J. Syme)

The main criticism of these lower volume toilets is that they often require more than one flush to completely remove all of the waste. This is addressed by some models of toilets which have Dual-Flush adapters. These toilets provide lower flow for liquid only waste and higher flow for solid waste. This reduces the need for double flushing when higher flows are needed. (Nancarrow, Blair E., Clive Seligman and Geoffrey J. Syme) However, these should not be considered completely practical for KU because most of their toilets are pressurized toilets and this is mostly a design for gravity flow toilets, like those in residences. (Peterson, John E. et al)

More water efficient measures do exist, however. Composting toilets, for example, use no water and could save 1,248 gallons per person per year over the 1.6 gallon per flush versions. However, the practicality of having composting toilets on the University is very limited. The up-front cost of a composting toilet system for a “small commercial building” is, 5000-20,000 dollars (Vickers Amy). This along with the associate costs of extra maintenance and transport of the composted waste makes this type of system a non-viable solution for KU. (Hansen)

There is a more practical no water solution, which has been used by other universities. No flow urinals use a drain insert, which allows urine to flow into the trap and it is then sealed under a biodegradable liquid seal, which floats on top of the waste <Refer to Appendix 4>. (Peterson, John E. et al) According to their website on sustainability, the University of Arizona has installed some of these water free urinals and found that they have saved 40,000 gallons of water a year per urinal. Some disagreement on the cost effectiveness of the urinals exists. Craig Hansen says that the university has looked into this option but the amount of maintenance to keep these devices sanitary along with the cost of replacing the liquid cartridges every 1,500 uses was prohibitive. The San Diego Union High School District however found a net yearly savings on maintenance and water cost of \$4,900 after installing 20 fixtures. (Petersen, John E. et al)

Irrigation

Irrigation on campus consumes a large amount of water. The landscaping along Jayhawk Boulevard is used to beautify campus which not only is aesthetically pleasing but it also helps attract potential students and their families. There are areas around campus though which are not as visible and could have the lawns replaced with native plants which require no extra watering and can still serve to help make campus attractive.

Replacing lawns in low visibility areas is being used at the University of Arizona as well. Areas that are not seen by visitors as often have been converted to natural landscapes with drought tolerant plants. Kansas is not as dry as Tucson, but plants native to Lawrence are also drought tolerant enough to survive without any extra watering from irrigation.

Natural landscaping though should not be hidden from the public. In fact, adding an area of native plants would be a strong sign of community leadership on the part of the University. The University should set up a demonstration garden with native plant

species that are beautiful, easy to maintain, and drought tolerant. This would be a place where community members could get ideas and inspiration on starting a natural landscape around their own homes, decreasing the city's water use overall, and helping to further protect this limited resource.

Graywater is often viewed as an effective way to reduce water needs by using what has already been taken up from the water source. This water is then stored for non-potable uses, such as to be used in cooling towers or for irrigation. Also, according to their sustainability center's website the University of Arizona currently has a system in place which uses graywater for irrigation coupled with an already very efficient irrigation system. Due to upfront costs associated with restructuring plumbing so that water can be reused, graywater may not be the most effective way to use resources. Graywater systems also tend to lessen incentives for individuals to reduce their water use because they may think that since the water is being reused, reducing water use is not necessary. (Hansen)

Rainwater, however, is free to use. The use of cisterns to hold large quantities of rainwater which could be used for irrigation is a real possibility. Georgia Tech University has taken this step to use two 100,000 gallon cisterns for irrigation. These underground reservoirs were built as part of the construction process for a new building. They collect water from three sources and the water is enough to sustain the irrigation needs of the campus for three weeks. (Langston)

KU could also have this type of storm-water retention system to be used for irrigation. Using Georgia Tech as a model and including new tanks and filters to be added somewhere on campus is a possibility. There is another option though. Two tanks already exist buried underground off Sunnyside Ave. These two tanks previously were used as fuel storage tanks, but now sit empty. There is significant work which would have to be done in terms of bio-remediation to clean the tanks so they could safely be used. With the structures already in place, and a storm sewer drain, which runs only forty feet from the tanks using them as cisterns to collect rainwater is a possibility. ("Graywater Proposal for Sunnyside Avenue")

Certain problems exist with turning these fuel tanks into cisterns. The main one is the remediation needed to clean them sufficiently so that they can be used safely for irrigation. Proponents of using the tanks as cisterns argue that to properly dispose of these containers that cleaning would be needed regardless. Thus, it would be a better use of them to allow for them to be used as cisterns. The cost of modifying the tanks to work as irrigation holding tanks must also be considered. Adding filters to keep the water free of debris and pumps to bring water up for use would be costly requirements. (Vickers) Limiting run-off into the sewer system as well as reducing irrigation costs make this an important option to consider.

Short-Term

With the tightening of the University's budget, large-scale changes with high upfront costs seem unlikely to occur. However, there are a number of ways in which the University can cut down on water use at little or no cost. These mainly involve changing the way people use water on campus; people's minds are relatively easy to change, pipes are not.

Residence Halls

As part of this research a survey of dorm residents was conducted to find out about their typical water use habits <refer to appendix 2>. It was found that water use by dorm residents is less than conservative. The survey showed that 18 out of 52 individuals surveyed said that they showered between 8 and 11 times a week. Four people even said they showered more than 12 times a week. This type of excessive water use contributes to waste and costs the university money which could be saved by educating people that showering everyday is not necessary, and especially, showering more than once a day is just excessive.

The survey also showed that the average male dorm resident takes about 6-10 minutes per shower where as the average female dorm resident spends 11-20 minutes per shower. This may sound like the males are doing better in terms of water use, but the survey showed a trend that male students while their showers may be shorter they take more of them in a week.

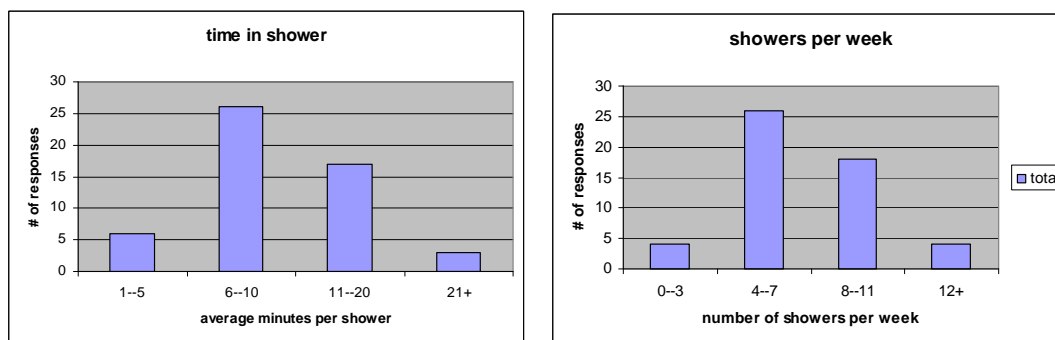


Figure # 4: Charts showing response to the questions how many time do you shower per week and how long are they.

To address this problem there should be a public awareness campaign to inform dorm residents as well as other students about easy ways to conserve water. This campaign would suggest things such as simply taking shorter showers, and leaving the water running while shaving or brushing your teeth. It would also address good daily water use planning. One logical explanation for showering multiple times a day would be if a person showered in the morning, then exercised in the afternoon or evening and had to shower again. Giving people a reminder to plan ahead so if they plan on exercising and showering later to hold out on showering until that time. A more radical suggestion that could be included would be to simply not shower as much. While many of those surveyed said they showered more than eight times a week, 30 individuals stated they shower at most once a day and four individuals even said they get by showering at most three times a week. This shows that many college students get by with what some may consider limited showering. When suggesting this reduction, part of the promotion for water conservation would be giving the suggestion of washing with a rag at a sink rather than taking a full shower. This seems to be an archaic practice, but could help hold some people over between showers. (Gram-Hansen)

The major portion of this education campaign would be a series of posters, which could be posted in the residence halls and even in individual bathrooms, both communal and private. The purpose of the poster campaign would be to educate individuals about

why water conservation is necessary, what happens to their water, and easy ways to reduce their water use in their dorms and around campus.

The poster should also contain information on the amount of water used per minute in the shower to give the students a perspective on just how much water they are using. Feedback on the actual amount of resource use has shown to cause reduction in resource use <refer to appendix 3>. (Nancarrow, Blair E., Clive Seligman and Geoffrey J. Syme)

Public awareness campaigns, however, have been determined to have mixed results. (Peterson et al) Different strategies could be used to get students to reduce their water use. For example, a contest could be a fun, engaging way to influence participation by students. Metering done regularly at each residence hall could be recorded and used to fuel a competition between the dorms with some sort of communal prize for the winner at the end of a semester. The University of California Santa Barbara, Duke University, along with others have used this strategy in concert with other techniques to engage students and reduce water use by individuals around their campuses. (Cure)

Leak Reporting Program

Along with these strategies for water conservation a general campuswide campaign should also be started to empower students and faculty to report any leaky or broken water fixtures (toilets, sinks, pipes, etc.). This campaign would involve having signs up in bathrooms with information on who to contact at Facilities and Operations to get the problem fixed promptly to stop any water waste. These posters would be much more simple with information to contact FO by email, phone, and even a text message. The text message system will cut down on how long it takes to report a problem, ease the call burden on FO, and should then increase the likelihood that a person would actually report a leak. Simply repairing a dripping faucet in a timely manner can save a lot of water. Depending on the size of the drip it could be wasting 5 to 55 gallons of water per day. (Vickers)

Summary and Conclusion

Recommendations for The University would include educating students and various faculty and visitors who use the water appliances on campus on how to conserve water, using examples from other universities to promote conservation through public awareness and the usage of efficient fixtures, acting as a role model for the entire City of Lawrence to be more aware of the importance in water conservation, and thinking critically of the ways in which the campus is run and how it affects the level of water use. The University of Kansas is already making efforts to improve upon the efficiency of water use as well as limiting pollution of runoff; however, there are a number of simple changes that can be made to the way certain procedures are carried out that would significantly decrease water consumption on campus. Conservation at the University can happen through a variety of different means. Individuals can make a conscious decision to decrease the amount of water they use. Or, conservation can come from major changes to the infrastructure on campus that may be initially costly, but with proper use pay off in a big way. Water is an important and increasingly limited commodity. This report should

serve as a guide for the KU community that can be used to further protect this limited resource.

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Appendixes

Appendix 1

Charts showing changes in water use and price from 2007-2009 to date.

Mgal = 1000 gallons cost is in USD



Main Campus water use (includes irrigation)



Main campus sanitary sewer (excludes irrigation)

Note: These Figures do not include west campus or building operated by Department of Student Housing

Source: Craig Hansen

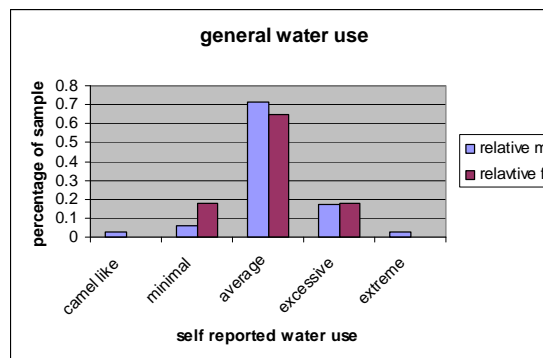
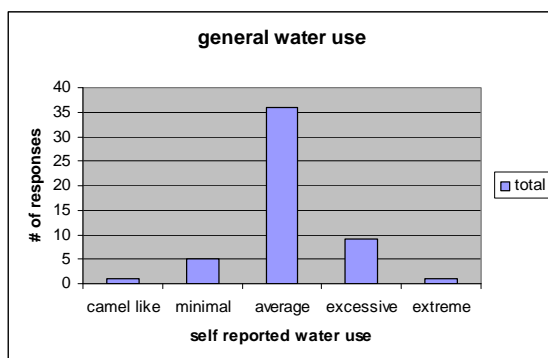
Appendix 2

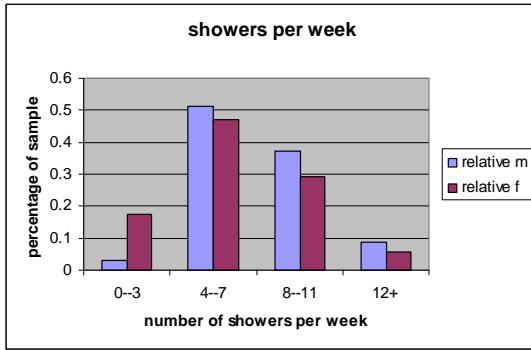
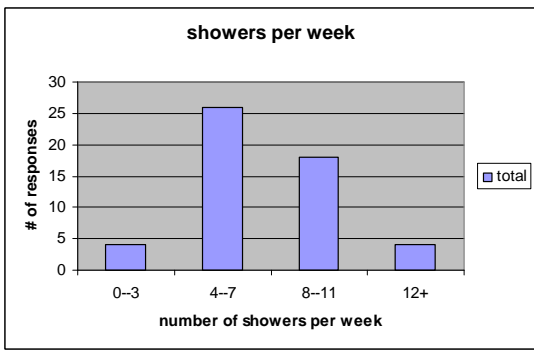
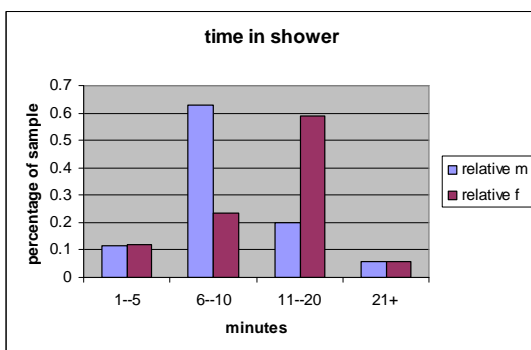
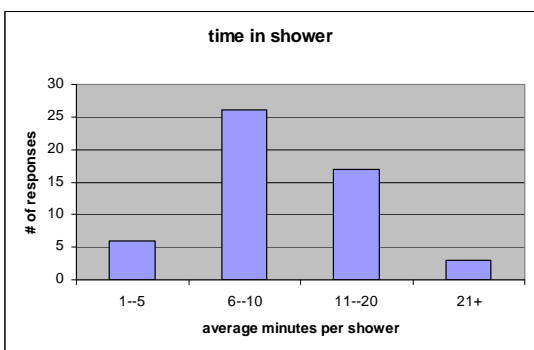
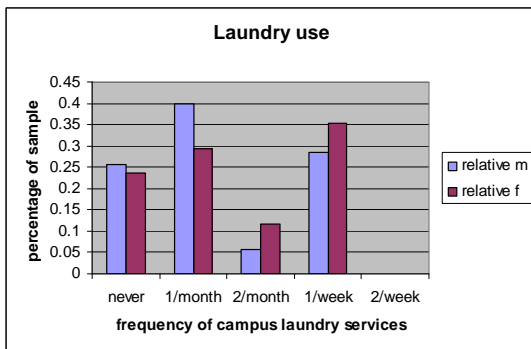
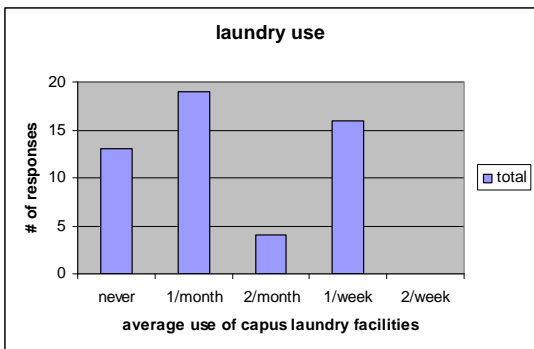
Males: 35 Surveyed

Showers/week	0-3	4-7	8-11	12+	
	1	18	13	3	
Time in Shower	1-5 min	6-10 min	11-20 min	21+ min	
	4	22	7	2	
Laundry use	Never	1/month	2/month	1/week	2/week
	9	14	2	10	0
General Water Use	Camel Like	Minimal	Average	Excess	Extreme
	1	2	25	6	1

Females: 17 Surveyed

Showers/week	0-3	4-7	8-11	12+	
	3	8	5	1	
Time in Shower	1-5 min	6-10 min	11-20 min	21+ min	
	2	4	10	1	
Laundry use	Never	1/month	2/month	1/week	2/week
	4	5	2	6	0
General Water Use	Camel Like	Minimal	Average	Excess	Extreme
	0	3	11	3	0





Appendix 3

FEELING DIRTY?



USE YOUR TIME IN THE SHOWER WISELY

Showerheads release water at an average of 2.5 gallons each minute.

Only 2.7% of the earth's water is fresh and a mere 1% of that is usable by humans.

As we continue to pollute our waterways and treat water as though it is unlimited, this number continues to drop.

Keep It Fresh

Think about the ways you can conserve water....

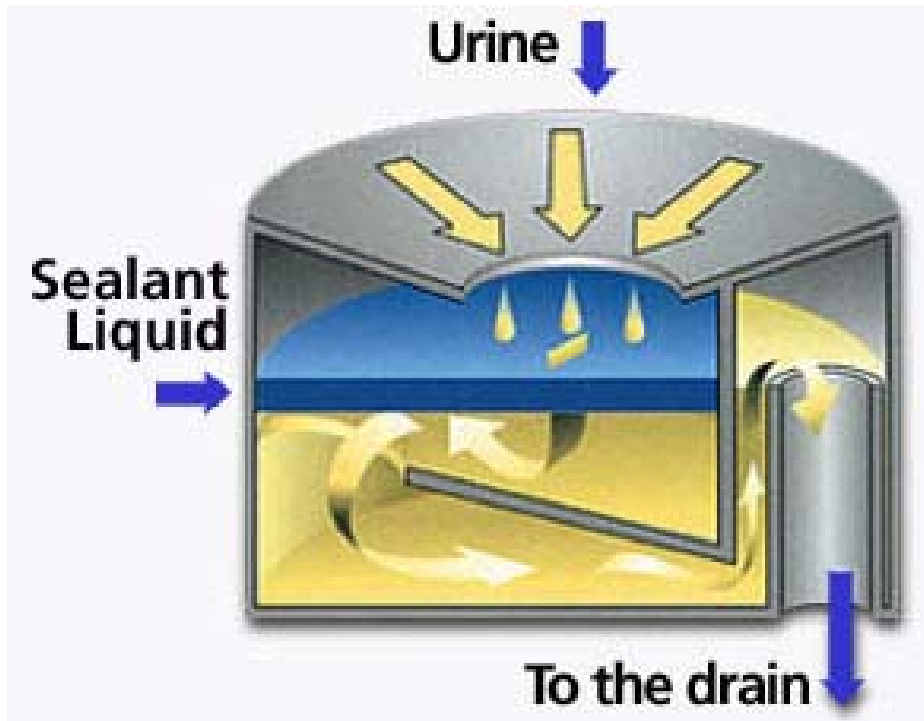
~ *Are you using your time efficiently? The shower is not a place for sleeping, drinking, or eating. Ponder life's great questions while shampooing.*

~ *Are you practical about the times in which you choose to shower? (EG are you going to be exercising later today? Maybe you should hold off on showering until afterwards)*

~ *Try not to leave the water running in the faucet while brushing your teeth or shaving.*

Appendix 4

Diagram of Water-Less Urinal



source: <http://www.falconwaterfree.com/how/>