

Planning for Water Resource Management

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PLAN 597

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PLAN 597

Planning for Water Resource Management

Historical Water Usage of Campus Infrastructure

UBC Vancouver – Marine Drive Residence, Building 6

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Introduction

UBC has recently undertaken the task to “greenify” the campus; with plans to have zero net carbon emissions by 2050, the university has been busy upgrading older buildings with energy efficient fixtures. As well, the university has been installing new water-reduction fixtures in buildings in order to reduce water consumption. Many of the buildings (laboratories, residences, lecture halls, etc) have already had this work completed, but as of yet no quantitative analysis has been completed to determine the effectiveness of the project. Under the supervision of Dr. Honey-Roses, students from PLAN 597 have set out to complete this analysis. This submission details the historical water usage of *Marine Drive Residence – Building 6*. This building has not had any fixture retrofits completed, however it is a relatively new construction (completed July 2008) and the water usage is still of interest to determine how it compares to older buildings, as well as older buildings with new fixtures.

Marine Drive residence was completed mid 2008, and consists of five buildings that house students (three towers, two “podiums”) as well as a central commons block. The entire complex houses approximately 1600 students, and while an official number could not be found, staff at the Marine Drive front desk indicated there are approximately 350 students who have year-round housing in building 6.

Using monthly data obtained from UBC for the period of January 2010 – September 2014, this report investigates general trends in water usage and will provide a framework to compare Marine Drive Building 6 water usage to other on-campus buildings. The majority of data was transcribed as-is, with a few exceptions: In two cases there were missing data entries, and the water usage for that month was calculated as the average of the preceding 12 months. In one case the data entry for one of the registers did not make sense, and was ignored, with a similar estimation completed. And finally, the initial January 2010 reading appears to be higher than the February reading and has been ignored (see attached raw data).

The choice of monthly data was not intentional – UBC only keeps monthly or quarterly records. As a relatively new building, quarterly data did not provide sufficient data points. However, monthly data is sufficient to compare this building to others on campus. Higher frequency readings would not help in this analysis, but could prove interesting to investigating patterns within student life, such as normal waking hours, hours spent in residence, etc.

Results

The 53 months of data were analyzed in Excel (January 2010 – September 2014, excluding outliers), and the results are presented below.

Summary Statistics	
Mean (m ³)	762.6
Median (m ³)	744.2
Variance	38102
Standard Deviation	195.2

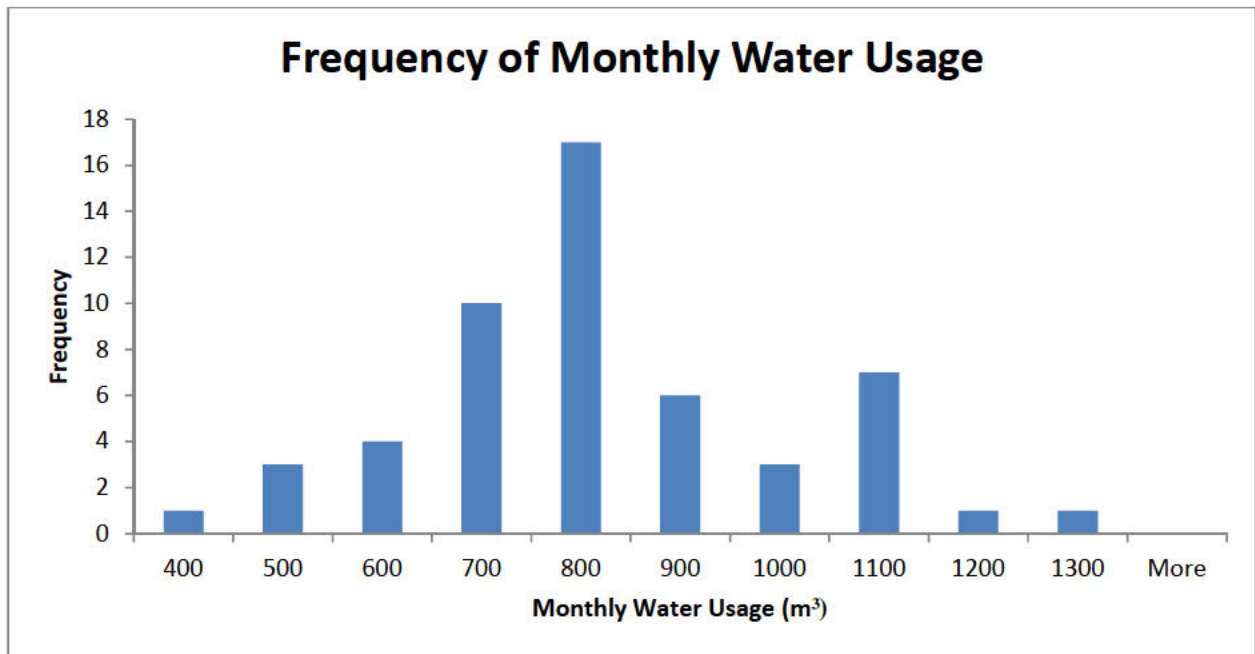


Figure 1 - Histogram detailing frequency of monthly water usage

The histogram shows somewhat expected results; water usage month to month follows a normal distribution which has the most frequent monthly water usage in the 700-800m³ range. However, there is an unexpected spike in the 1000-1100 range. Investigating further, these 7 instances occurred in:

- February – 1
- April – 1
- July – 1
- August – 1
- September – 2
- October – 1

From that result, there is no evident correlation between month of year and high water consumption. In addition, as Figure 2 shows, there is an overall upward trend, which accounts for at least four of those

“spikes” as simply a trend towards a new mean and removes the possibility of a seasonal water-use spike.

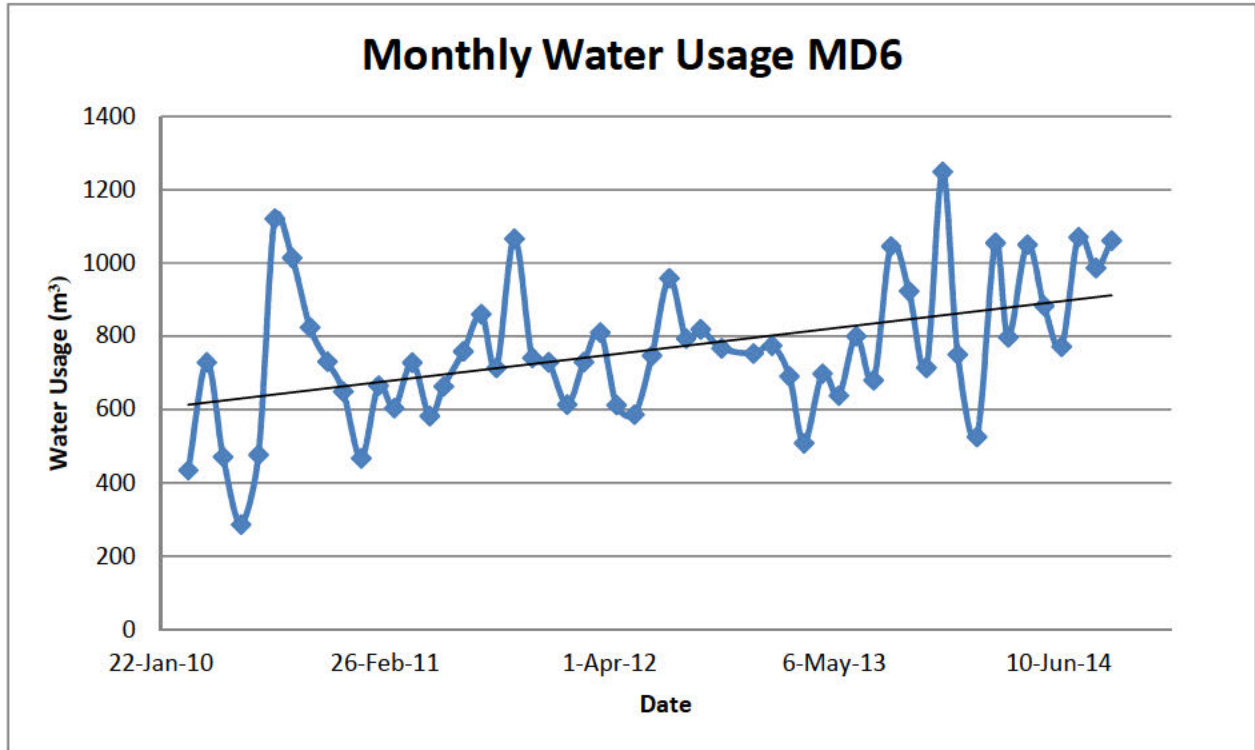


Figure 2 - Water consumption over time (January 2010 - September 2014)

Figure 2, above shows that in general, water usage is trending upwards over time. As Marine Drive building 6 has been fully occupied since opening, this indicates that the residents are actually increasing their water consumption measurably. Over a four year period, the average monthly water consumption has increased by approximately 300m³ per month. With approximately 350 students, this amounts to an increase of 850L per month of water.

As discussed earlier, there do not appear to be seasonal patterns, as the spikes occur at different times of the year. However, in August 2010 (the first large spike) there is a rapid increase in water usage followed by a slow decline (yet still above the mean). Without information available it is impossible to determine the reason for this, however if the water usage includes landscaping use, it is possible that some work was done during the summer months of 2010 as UBC Plant Operations commonly carries out large projects when the majority of students are away.

Renovation Discussions

Marine Drive Building 6 has not undergone any fixture retrofits.

Additional Discussion

At the time of writing this report, there is only one other building analysis completed (Walter Gage – South Tower, Brady Fraught), but an interesting comparison can be made to it. Walter Gage is a much older residence, constructed in the 1970s. From Brady's analysis (Figure 3), it appears that pre-renovation, the average resident used $3.3\text{m}^3/\text{month}$ (mean water usage 1500m^3 with 450 students in the tower).

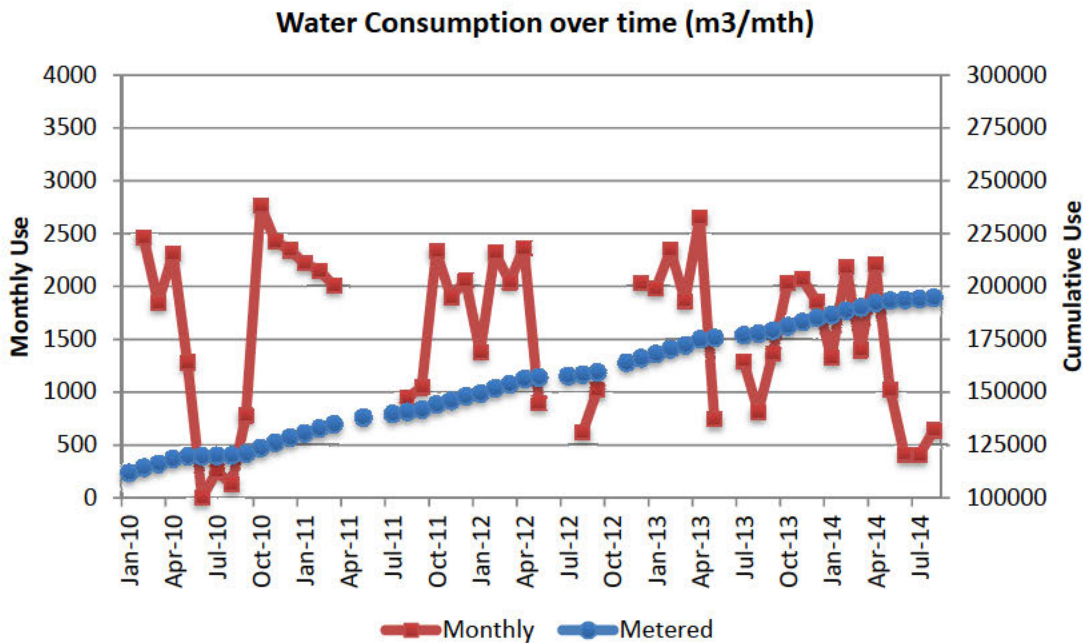


Figure 3 - Gage Tower South Water Usage (acquired with permission from Brady Fraught)

In comparison the residents of Marine Drive 6 used an average of $2.2\text{m}^3/\text{month}$ (mean water usage 762.2m^3 with 350 students in the tower). With both towers housing students who likely have similar living styles and usage patterns, this is a clear indicator that the technology used in the newer building is much more usage efficient. It will be interesting for the UBC water management team to see if the retrofits to Gage south (implemented September 2014) bring the usage down to a similar level as Marine Drive.

A cause for concern is the increasing water usage in Marine Drive. Whereas Gage tower shows a relatively consistent mean, the average water usage in Marine Drive has been trending upwards over the last four years. As the tower has been fully occupied since opening, there is not any obvious factor that is contributing to the growing water usage. There is a possibility that the water used for landscaping and irrigation passes through the same meter, which could explain gradual changes as more complex landscape systems are set up. However, if this is not the case, a serious investigation should be launched; is this simply a case of students becoming more cavalier with their water use, or is there a loss of efficiency within the system? In either case, a few changes to attitudes or equipment could see the water use brought to a stable level.