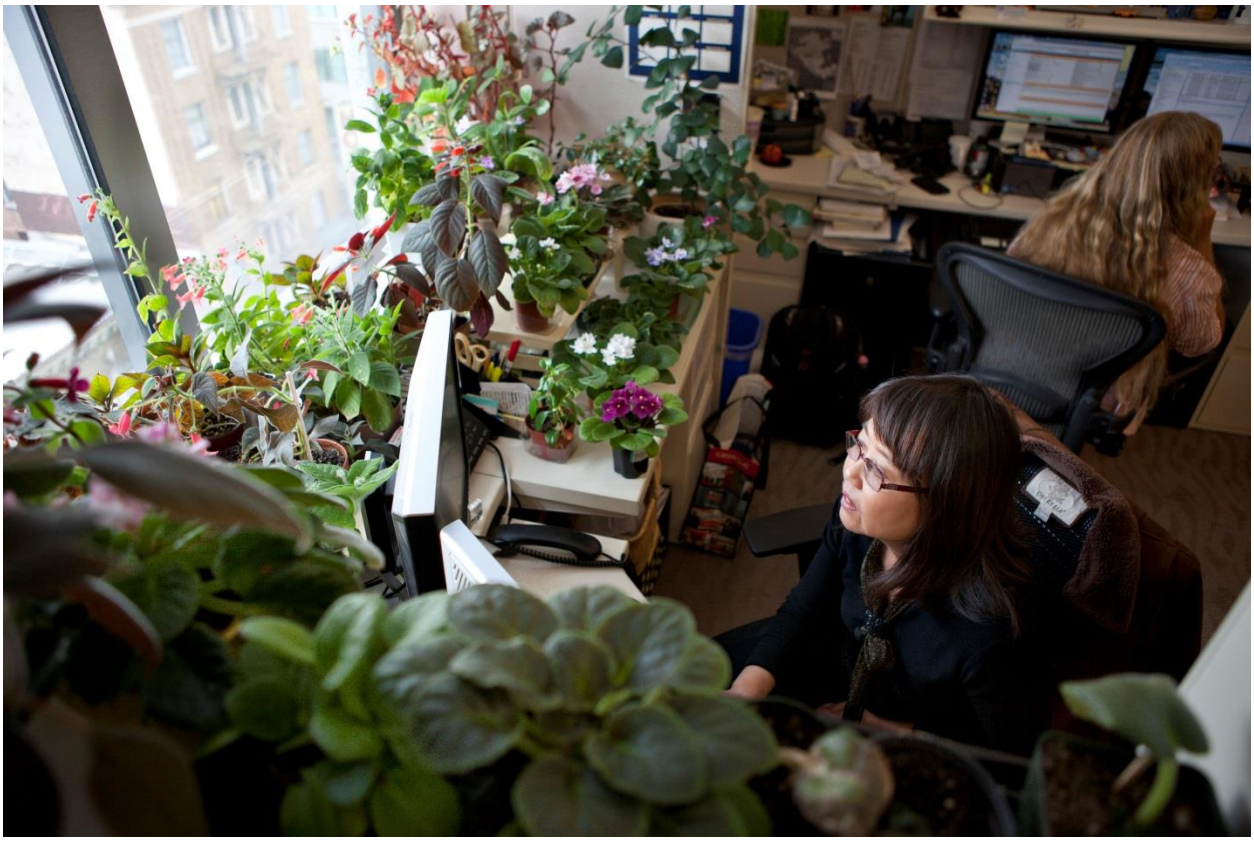
University of California, Office of the President
Water Action Plan, 2019



Plan updated in 2019 by:

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Executive Summary

The University of California Office of the President (UCOP) Water Action Plan (WAP) was originally developed in 2017 to meet the University of California (UC) sustainable practices policy (the Policy) growth adjusted goals of 20% water use reduction by 2020 and 36% reduction by 2025. In addition, the plan was developed to meet the Policy requirement that all sites create and submit a WAP to the UC Office of the President by December of 2017. This document was updated in 2019.

The key finding is that that at 47% reduction UCOP has already met the 2025 growth adjusted target of a 36% reduction from a 2005-2009 baseline. However, savings to-date are due mostly to a change in activities supported by UCOP facilities. That is, the removal of large water cooled computers from 20th Street in Oakland. Additional water savings in future years are anticipated as dispersed sites in Oakland are centralized into 1100 Broadway.

The WAP reviews four main sites in detail to identify; building specific targets, recommended water savings actions and management procedures. These sites are; Oakland (1111 Franklin and the future 1100 Broadway), UCDC, UCPath and La Casa Mexico.

No UCOP sites currently have water data logging (batch or live interval metering). This lack both limits the ability to analyze water savings opportunities, and exposes potential water savings and risk mitigation opportunities. Data from water loggers placed strategically can identify surprisingly common base flow leaks, allow for identification of inefficiencies and, if integrated with real-time management and alarm systems can reduce the risk from flooding. It is recommended that UCOPs main four sites progress with data loggers for main meters (at a minimum) and seek funding from the UC risk mitigation grant program “Be Smart About Safety” to source funds for meter calibration, data logging, real time monitoring, alarms and remote valve shut off. A real time data logging service is available through many systems. However, as 1111 Franklin already utilizes Lucid which allows for real time monitoring and alarms, cost estimates for system set up at each site with Lucid have been used. Additional data is required source solutions that include remote water value shut downs to prevent floods remotely; this would meet the Be Smart About Safety goals most effectively. It is anticipated that at each site, loggers would also be set up to send data to the other service currently being used by UCOP, Buildings Alive. This will allow for base flow leaks and inefficiencies to be identified by third party building engineers and UCOP building managers notified of potential corrective actions.

The WAP was updated in 2019 with information about actions that have been taken on the recommendations below. Details are in each location’s section. Items that have been crossed out in the tables and lists below indicates that they were completed.

1111 Franklin

1111 Franklin appears to be operating somewhat efficiently. Target water use range for 1111 Franklin is 1500 and 2000 CCF/ yr (or 4.2-5.6 (CCF/kft2/yr)), for 2017/18 1111 Franklin is operating just outside that

within that range at 2863. Analysis of available data indicates possible leak in the building. Recommended actions for 1111 Franklin are as follows:

Recommendations	One off costs	Ongoing costs /yr	Savings Estimate /yr	Simple payback	NPV
~~Installation of additional meter at Cafe~~	~~$2,000~~		$4,720*	1.66 yrs	$40,932±
Installation of data loggers for 3 meters (cafe, main meter and cooling tower make up water)	$3,450				
Systems for alarms (lucid) set up and ongoing**	$2,000	$180			
~~Water reduction stickers in bathrooms~~ (completed)	~~$100~~				

*Note Savings are not DIRECTLY attributable to actions but assumed outcomes from implementation (additional costs may be incurred)
± Assumes CPI at 3%, Discount rate at 5% and project life of 10 years
**Further work needs to be undertaken to determine the costs of systems with remote shut of valve capabilities to meet the needs of the Smart About Safety Grant program.

1100 Broadway

Best practice water recommendations for 1100 Broadway are as follows:

1. Installed fixtures shall so be of the highest efficiency possible and Water Sense certified (if available) for a given application.
2. No sensor flushing should be used due to maintenance and water waste concerns
3. Water meters must be inline installed (or compatible alternative approved by the client team) for hot water supply, cold water supply, as well as cooling tower make up water and bleed line. In addition, any outdoor landscaped areas must be sub-metered. Sub meters should be installed for the sewage discharge also if possible.
4. Any retail tenants should also be separately sub metered with billing grade meters.
5. Install filtered water taps with instant hot water at break-room sinks instead of standalone water coolers.

UCDC

UCDC has significant water and cost savings opportunities available from fixture upgrades. Target water use range for UCDC is 4900-6000 CCF/yr and use was 6079 in 2017/18. Recommended action would reduce water use to within the target range. In addition, an upward trend in water use despite consistent occupancy as well as high water usage compared to benchmark suggest that water use savings are likely to be identified through the installation of water loggers. Recommended actions for UCDC are as follows:

Recommendations	One off Opex	Ongoing costs/yr	Savings Estimate	Simple payback	NPV±
~~Water fixture upgrades kitchen and shower~~	~~$1,635~~		~~$13,117~~	~~>1 year~~	~~$94,817~~

~~Water fixture upgrades bathroom faucets~~	~~$470~~		~~$5,651.33~~	~~>1 year~~	~~$41,086.44~~
Logger installation main meter	$1,650	$180	N/A	N/A	N/A
Water reduction stickers in bathrooms	$300		N/A	N/A	N/A
Connections to live data systems and alarms**	$400	$1,200	N/A	N/A	N/A

± Assumes CPI at 3%, Discount rate at 5% and project life of 10 years

**Further work needs to be undertaken to determine the costs of systems with remote shut of valve capabilities to meet the needs of the Smart About Safety Grant program

UCPath

According to bills, UCPath water use has decreased slightly during a period when occupancy has been increasing. Target water use range for UCPath is 4.2-17.7 (CCF/kft2/yr), (to be resolved to a whole building target when fully occupied). The decline in water use stems largely from the removal of landscaped areas for a solar project and reductions to irrigation. In addition, the share of potable water use at the site is decreasing rapidly over time. As a relatively new LEED Gold building, with declining water use, in an area with extremely low water rates per unit, there are no apparent economic benefits for water savings. Best practice activities for UCPath in order of priority are:

1. Install loggers on the main water meter to enable future analysis of water use and detect leaks. These should be contacted to Buildings Alive service that can be achieved with no additional service costs. Cost approximately $1650 + $180/yr ongoing.
2. As with other sites, funding for data logging, alarms and remote shut of valves through the Smart About Savings Program should be investigated.
3. Install signage in all bathrooms informing users how to identify and report leaks, ~~set up a system for collecting and responding to reports.~~ See Appendix E for further details on this recommendation.

La Casa

The water use at La Casa in Mexico City has increased significantly. This is likely due to higher occupancy and increased use for events. Target water use for this facility is 4900-6000 CCF/yr, water use in 2017/18 was well outside of this range at 7298 CCF. Due to the mixed activities at La Casa, and the limits to available data, no water savings estimates are available. However, the following activities have been recommended:

1. Watering schedules should be examined. It is recommended that watering no more than 3 times weekly for 15 mins during dusk or at night be considered and tested
2. At a minimum faucets and showers on the property should be updated to meet LEED and WaterSense standards, more detail, including costs and savings on this recommendation will be provided after more information on the number and types of fixtures currently present at the site are gathered.
3. Install signage in all bathrooms informing users how to identify and report leaks, set up a system for collecting and responding to reports. See Appendix B and Appendix F for further details on this recommendation.

4. Consideration should be given to re-purposing the fountains at La Casa.
5. Consideration should be given to sub- metering the three buildings not occupied by UCOP eventually moving them off an all in lease.

Table of Contents

SECTION A: Introduction and Context

1. Document Overview

The University of California has made a system wide commitment to reduce its growth-adjusted potable water consumption by 20 percent by 2020 and 36 percent by 2025, when compared to a three-year average baseline of FY 2005-06, FY 2006-07, and FY2007-08. This document will serve as the plan for The UC Office of the President to achieve these goals.

This plan will present a baseline, using FY2006-07 and FY2007-08[1], highlight work and progress thus far, and lay out actions to be taken at University of California Office of the President buildings in Oakland (1111 Franklin and future 1100 Broadway), Riverside (UCPath Center), Washington DC (UCDC), and Mexico City (La Casa) to reduce water usage to meet system-wide targets.

The plan's contents includes an overview of UCOPs water use as a whole, and is then is broken into 4 sections for detailed analysis and recommendations reflecting the geographic locations of:

- Part B: Oakland (1111 Franklin and the future 1100 Broadway)
- Part C: Washington DC (UCDC)
- Part D: Mexico City (La Casa)
- Part E: Riverside (UCPath Center)

In response to the UC Policy requirements this document also contains a section on turf, single pass cooling, storm water management, Communication and Education and ongoing reporting any plan updates (Part F).

2. Site overview

For the purposes of this plan, and UCOP water reporting the relevant boundary is *financial control*. Broadly speaking, this equates to the inclusion of all sites where UCOP pays the water bill in reporting against the water targets set in the University of California Sustainable Practices Policy.

UCOP owns and leases space primarily in California, but also has properties in Washington D.C. and Mexico City. All are primarily office buildings, with the exception of a mixed residential-office building in DC for UCDC participants. La Casa in Mexico City and UCPath in Riverside are the only properties that contain landscaping that requires significant water usage.

[1] No data is available before 2006, as such an average of the available years (FY2006-07 and FY2007-08) has been used as a baseline.

Buildings owned by UCOP are: 1111 Franklin Oakland, Blake Estate, UCDC, 415 20th Oakland, 1130 K Street Sacramento, Casa de California Mexico City, and the UC Path Center.

Of these a number of buildings are due to be removed from the UCOP portfolio within the next 12-18 months (Sacramento and 20th Street) and have been excluded from the plan. A new building (1100 Broadway) is currently at the early stages of construction, while this building will not be owned by UCOP, general recommendations have been included at the end of this section.

Buildings leased by UCOP are: Kaiser Center Oakland, 1200 Lakeshore Avenue Oakland, UC Press, 1111 Broadway Oakland (13th, 14th, and 21st floors), and Office of Tech Alliances Irvine. A summary of inclusions in the water reporting and the water plan follows.

2.1.Summary of Facility Inclusion in Water Use Reporting and the Water Plan

A summary of inclusions and exclusions from the water plan can be found below.

Water reporting and planning boundaries UCOP

UCOP Facility	Comments	Included in Reporting	Included in Water Plan
1111 Franklin	Under financial control and to be maintained by UCOP	✓	✓
415 20th Street	Under financial control and NOT to be maintained by UCOP	✓	×
Blake Estate	Under financial control, unoccupied	✓	×
Casa de California	Under financial control and to be maintained by UCOP	✓	✓
UCDC	Under financial control and to be maintained by UCOP	✓	✓
1100 Broadway (when online)	Under financial control and to be maintained by UCOP	✓	✓
UC Path Center	Under financial control and to be maintained by UCOP	✓	✓
1130 K Street Sacramento	Under financial control and NOT to be maintained by UCOP	✓	×
Kaiser Center	Not under financial control	×	×
1200 Lakeshore Avenue	Not under financial control	×	×
1111 Broadway Avenue, Floor 13, 14, 21	Not under financial control	×	×
Office of Tech Alliances	Not under financial control	×	×

3. Context – Statewide University of California Policy

3.1. UC Policy

Within the Sustainable Practices Policy, the University of California has made a systemwide commitment to reduce its growth-adjusted potable water consumption by 20 percent by 2020 and 36 percent by 2025, when compared to a three-year average baseline of FY 2005-06, FY 2006-07, and FY2007-08 (University of California, 2016).

The Procedure section of the UC sustainable practices policy requires that this plan address the following sections: reporting boundaries, water usage and reduction strategies, stormwater management, education and outreach, irrigation and landscape

The application of growth adjustment to UCOP's policy aims is explained in the following section (2.1.1).

3.1.1. Policy normalization Weighted Campus User applied to UCOP

Normalization in this the water section of the UC Sustainable Practices Policy references STARS Weighted Campus User Calculation applicable in the current year (2017).
Weighted campus users = (A + B + C) + 0.75 [(D - A) + (E - B) – F]
Where:
A= Number of students resident on-site
B= Number of employees resident on-site
C= Number of other individuals resident on-site and/or staffed hospital beds
D= Total full-time equivalent student enrollment
E= Full-time equivalent of employees (staff + faculty)
F= Full-time equivalent of students enrolled exclusively in distance education

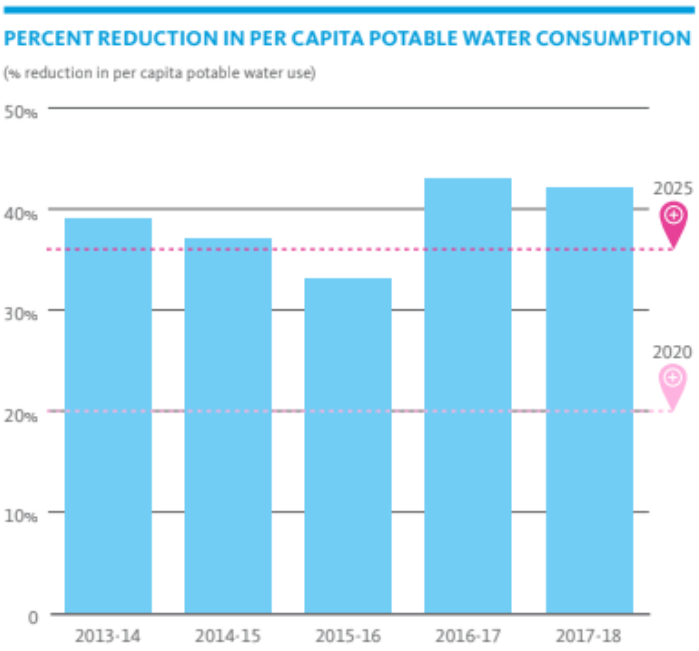
UCOP has residential occupants in UCDC and FTE staff at all locations. For UCOP, the WCU calculation can be summarized as: (1 x (C) number of residents) + (.75 x (E) FTE)

Where there are additional (non-UCOP) tenants in a location, these have been included in wcu numbers as their water use is not separable from UCOP use and their usage is under UCOPs financial control.

4. UCOP Results

While the UCOP water use reduction policy calls for a baseline determined from water use between FY2005-06 to FY2007-08, no water usage data is available from UCOP water records or local utilities in 2005. As such 2006/7-7/8 has been used as a benchmark (Baseline: FY2006-08 = 19.664 CCF/wcu).

UCOP Progress against Policy Goals



Goal:

- 20% reduction from baseline in per capita potable water use by 2020.
- 36% reduction from baseline in per capita potable water use by 2025.

Progress:

2020 goal met
2020 goal met

2017-18 gallons per capita: 8,520

As a whole, UCOP has already exceeded the 2025 goal of a 36% reduction in water usage. As demonstrated above, most of the water reductions are due to the removal of water cooled computers in 20th street Oakland. Further work is recommended to progress with savings at a location level to meet the intent of the policy goal.

5. UCOP Results By Building

Water use and reductions per building

Building	Baseline (CCF/wcu)	FY 2015-16 (CCF/wcu)	Percent Change	2016-17 (CCF/wcu)	Percent Change
Franklin	4.043	3.531	-12.66%	3.782	-6.45%
415 20th Street	68.807	18.142	-73.63%	16.174	-76.49%
UC Path	N/A	18.121	N/A	15.184	-16.21%
UCDC	35.812	41.157	+14.92%	29.579	-17.41%
Sacramento	6.129	1.761	-71.26%	3.381	-44.84%
La Casa	19.266	23.120	+20%	22.700	+17.82%
Blake Estate	0	0	-	0	-

6. Best Practice Benchmarks

The following two best practice benchmarks have been used to inform the water plan:

Office Buildings: 4.2 to 17.7 CCF/kft^2/year
Residential: 19-21 CCFs per/wcu/year

6.1.1. Office Buildings

The Real Property Association of Canada has found that water consumption is more strongly correlated with square footage than number of users in a building regardless of location or activity. Weather impacts water use benchmarks, as such, using best practice guidance from Canada, Australia and the UK a best practice range of 4.2 to 17.7 CCF/kft2/year has been identified (REALpac, 2011).

6.1.2. Residential Benchmarks

Residential water and office benchmarks have been combined for the UCDC building because of the sizable residential student population on site. The Building Sustainability Index (BASIX) in New South Wales, Australia has outlined best practice water benchmarks for residential use. The Best Practice figure is 40% below the potable water average of a 'pre-BASIX' home (BASIX, 2017).

The BASIX benchmark is 19.206 CCF/per person/year. This can be broken down further to 5.1465 CCF/per person/year for discretional use, 4.599 CCF/per person/year for showers, 3.8325 CCF/per person/year for laundry, 3.066 CCF/per person/year for toilets, 1.9345 CCF/per person/year for kitchen use, 0.584 CCF/per person/year for bath uses. Using the LEED indoor water use reduction calculator, assuming best practice fixtures, the best practice value is slightly higher at 20.23 CCF/wcu/yr. As such, this plan adopts a best practice range of 19-21 CCFs per/wcu/year.

SECTION B: Oakland

Due to the planned removal of a number of buildings from the UCOP portfolio in Oakland, the only buildings to be addressed in planning and analysis at Oakland are 1111 Franklin (current) and 1100 Broadway (planned).

1. Local context

All UCOP sites must adhere to UC Policy, however, state and local water requirements are also important drivers shaping water action. For UCOPs Oakland properties the relevant references are California (state) and East Bay Municipal Utilities District (local).

1.1.California Context

Water conservation in recent years has been primarily driven by California's drought conditions and water usage restrictions put in place as a response to the drought. While the drought emergency was lifted in most parts of the state in April of 2017, it is imperative that water conservation still be practiced to prepare for uncertain water supplies, future water scarcity, and to accommodate for California's growing population, which is expected to reach 50 million by 2049.

The California Water Plan has identified conservation and water use efficiency as some of the main sources of new water in the future. As a large institution with a statewide presence, UC's actions can significantly increase the amount of water available for use in California (State of California, 2013).

Additional motivators to reduce UCOP's water use in California include regulations passed by the state legislature and local legislatures as well as incentives provided by water utilities (California Water Board, 2017).

Executive Order B-29-15 ordered restrictions to reduce institutional potable water use by 25% compared to 2013 through February 2016.

While the window for EO B-29-15 has passed and been rescinded, Executive Order B-37-16 emphasizes the importance of making water conservation a way of life in California. Actions called for in the previous order are integral to moving forward with this and future water conservation legislation.

Executive Order B-37-16 established a new water efficiency framework in California. It called for increased efficiency and conservation and for targets for different use types. Long-term conservation measures outlined include permanent monthly water use reporting, reducing leaks and wasteful practices, and improving drought contingency plans.

Executive Order B-40-17 recognizes the importance of long-term conservation and water efficiency in California's resiliency to future droughts and climate change. While it declares the end of California's drought, it underscores the importance of water conservation as a way of life moving into the future.

1.2. East Bay Municipal Utilities District

In 2017, East Bay Municipal Utilities District (EBMUD) offered rebates of $0.75 per billing unit for water conservation measures taken at business and government facilities (see below). Although the rebate has ended, from time to time, EBMUD may offer additional incentives for water conservation efforts (East Bay Municipal Utilities District, 2017).

Eligible actions included:

- Installation of proven and reliable water-saving hardware or systems.
- For complex or untested measures, feasibility must be verifiable.
- The volume of existing water use for the hardware, equipment, or process to which the conservation measure applies must be reliably estimated.
- Expected water savings from a hardware installation, retrofit, or system modification must also be reliably estimated.
- Costs associated with the measure must be reliably estimated.
- Implementation of a measure must reduce existing levels of demand and/or future demand for potable EBMUD water.
- Installation of High Efficiency Toilets (1.28gpf or lower) and High Efficiency Urinals (0.125gpf) may be done thru this rebate program. All fixture(s) need to be changed at the same time. Partial retrofit installations will be approved at the discretion of the District.

2. 1111 Franklin Facility Description

2.1. Equipment breakdown

The Franklin Building is 12 stories high, floors 1-4 are parking garages, and floors 5-12 are occupied by UCOP offices. It has a café managed by a third party vendor on the ground floor.

Table 1: Water Use by Floor at 1111 Franklin

Floor	Water Fixtures and Appliances
Ground Level	• Women's Bathroom: 2 toilets, 2 sinks • Men's Bathroom: 1 toilet, 1 urinal, 1 sink • 2 All Gender Bathrooms: 1 toilet, 1 sink • Conference Room: 1 kitchen sink • Café
Floors 5-11	• Women's Bathroom: 5 toilets, 3 sinks • Men's Bathroom: 2 toilets, 2 urinals, 3 sinks • 2 drinking water dispensers • 2 kitchen sinks • 1 cooling tower • Showers on 9th floor
Floor 12	• Women's Bathroom: 5 stalls, 3 sinks • Men's Bathroom: 2 toilets, 2 urinals, 3 sinks

	• President's Bathroom: 1 toilet, 1 sink (not retrofitted) • 3 drinking water dispensers • 3 kitchen sinks (1 not retrofitted) • Dishwasher

Table 2: Water Use Equipment at 1111 Franklin:

	Flush/ flow Rate	Notes
Toilet (male)	1.60 gpf	Flow restriction retrofit completed 2014
Toilet (female)	1.60 gpf	Flow restriction retrofit completed 2014
Urinal	1.00 gpf	Flow restriction retrofit completed 2014
Public lavatory (restroom) faucet	0.50 gpm	Flow restriction retrofit completed 2014
Kitchen faucet	0.50 gpm	Flow restriction retrofit completed 2014
Showerhead	2.50 gpm	Flow restriction retrofit completed 2014
Dishwasher	N/A	Not water sense
Cooling Towers		Separately metered
Drip Irrigation for minor landscaped area		Franklin Roof Garden
Café		Under third party management, not separately metered.

2.2.1111 Franklin Occupancy

Occupancy in 2016 was 802 FTE, an estimated occupancy of 5.5 days per week.

The building has two water meters, the main meter and one for the cooling towers, both have been read manually at approximately weekly intervals since October 2014. In 2019, a meter for the café was purchased.

3. Water Use Analysis

3.1. 1111 Franklin: Water Savings Activities to Date

The Franklin roof garden underwent a drip irrigation retrofit in 2016.

All lavatory and kitchen sinks with the exception of the one in the president's office were retrofitted with 0.5gpm aerators during a LEED EBOM[2] review in 2014. Flow rates went from 2gpm to 0.5gpm, which is consistent with LEED's commercial lavatory faucet baseline of 0.5gpm. Flushometers in all restrooms except for the presidential toilet were also retrofitted in 2014 to comply with LEED standards, commodes where not changed to low flow, and it is possible that new flow rates have increased water use due to the need to flush multiple times. Showerheads were retrofitted from 5 gpm to 1.5 gpm

[2] LEED EBOM – is a whole building rating tool for the environmental performance of existing buildings.

throughout the Franklin building. This flow rate is below the WaterSense recommended usage of 2.0 gpm.

The replacement of 2 leaky flow valves and 4 drip pans on the cooling towers were completed in 2015 and 2016, respectively.

The installation of meters on the main cooling tower as well as a submeter on the café water line are set to be completed by mid-2019. These are to be connected to the Lucid Aqua-Suite which will allow for ease of reading and monitoring the data.

3.2.Comparison to Best Practice Benchmarks

Despite a landscaped area on the roof of the 5th floor and a café on the ground floor (neither of which is separately metered), 1111 Franklin falls comfortably within the best practice of 4.2 to 17.7 CCF/kft^2/yr for water use. The data in the below table is calculated from EnergyCAP reported water usage for each fiscal year. The CCF is normalized by the kilo square footage of 1111 Franklin.

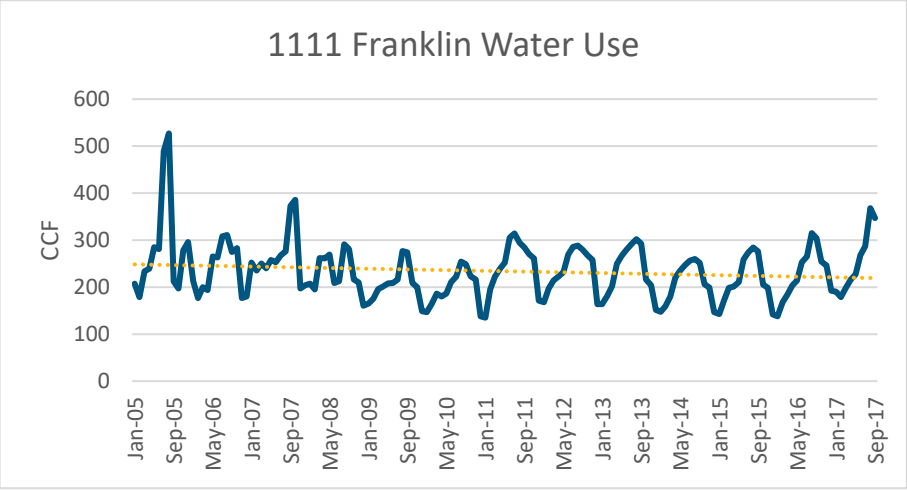
Table 3: Water Use at 1111 Franklin Compared to Benchmark

Building	2015-16 Water Use (CCF/kft^2/yr)	2016-17 Water Use (CCF/kft^2/yr)	2017-18 Water Use (CCF/kft^2/yr)	Best Practice Range (CCF/kft^2/yr)
Franklin Building	7.2	8.1	8.1	4.2-17.7

3.3.Water Use Trends: Annual

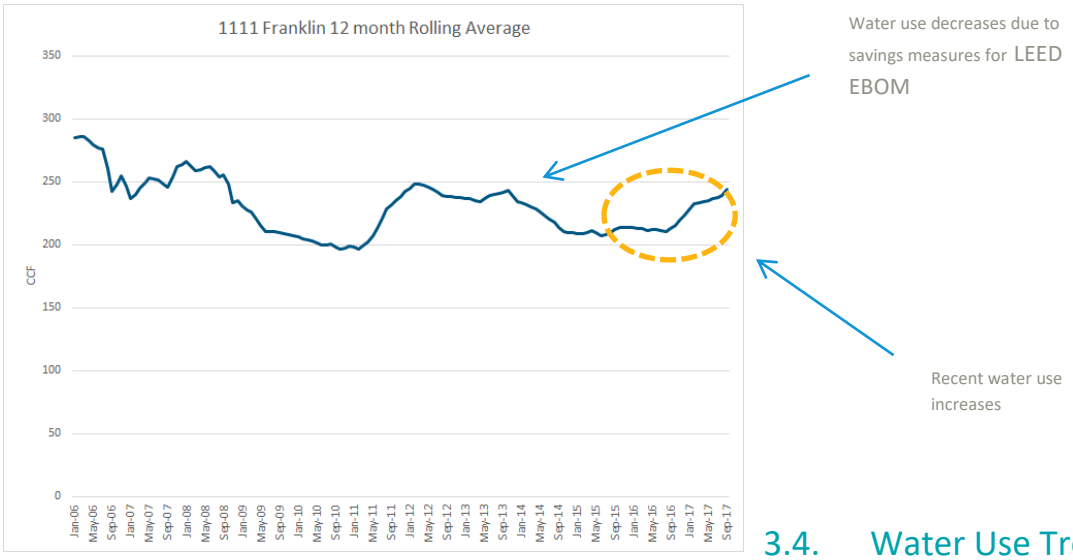
Graphs 1 and 2 plots water use based on utility bills from East Bay MUD, from 2005 to 2017. The graphs show a lower water usage during 2013-15 reflecting savings actions. However, despite no changes in occupancy of note, total water usage at 1111 Franklin has been increasing since 2015.

Graph 1: Time Series 1111 Franklin Water Use (Data Source - EBMUD bills)[3]



[3] This and subsequent graphs have not been updated since 2017.

Graph 2: 12 Month Rolling Average Time Series 1111 Franklin Water Use (Data Source - EBMUD bills)

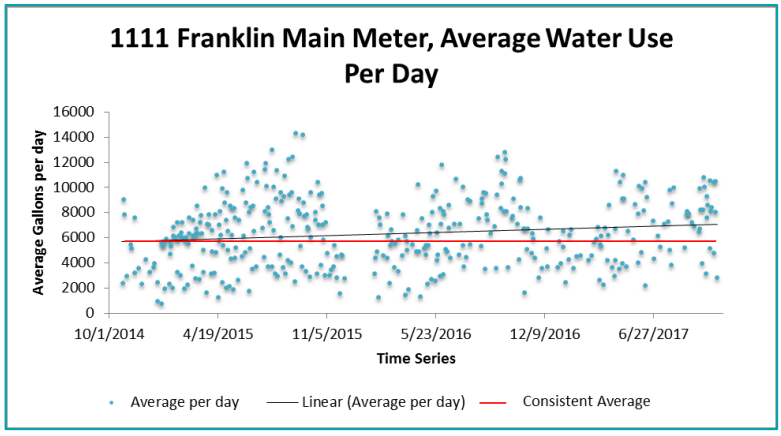


3.4. Water Use Trends

As noted above, 1111 Franklin has a main water meter being read at semi-regular intervals. The data from the meter reads was cleaned and daily averages calculated between reads. Data collection commenced in 2014 and no data was collected in January of 2016.

A scatter diagram below represents calculated daily averages over the time series during which data has been available.

Graph 3: Monthly Average of Daily Averages, 1111 Franklin

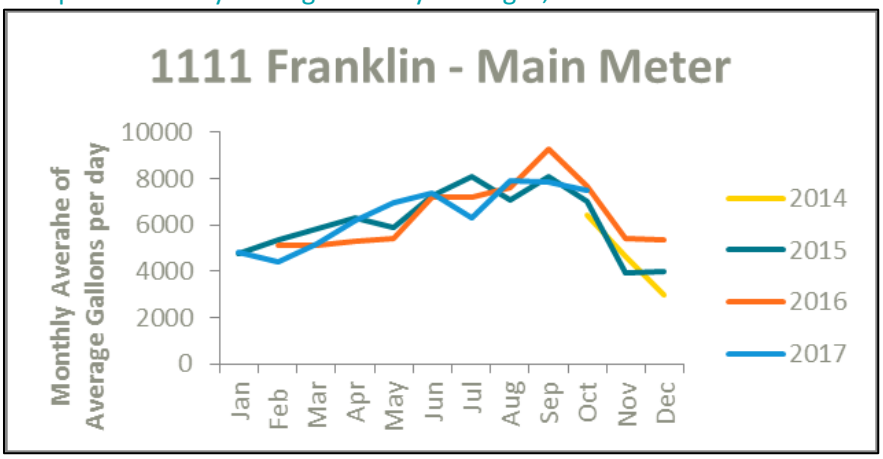


The line of best fit (linear average per day, black) represents the progression of daily average over the time series when data was available. The red line represents a consistent daily average over the time period and is included for comparison purposes.

Data from this graph suggests an increase in daily averages of about 1400G/day. It is worth noting that this is a very rough method of estimation, but represents the best available method from the available data. This suggests the need for the installation of a data logger, to detect leakage (see recommendation 1 and appendix C).

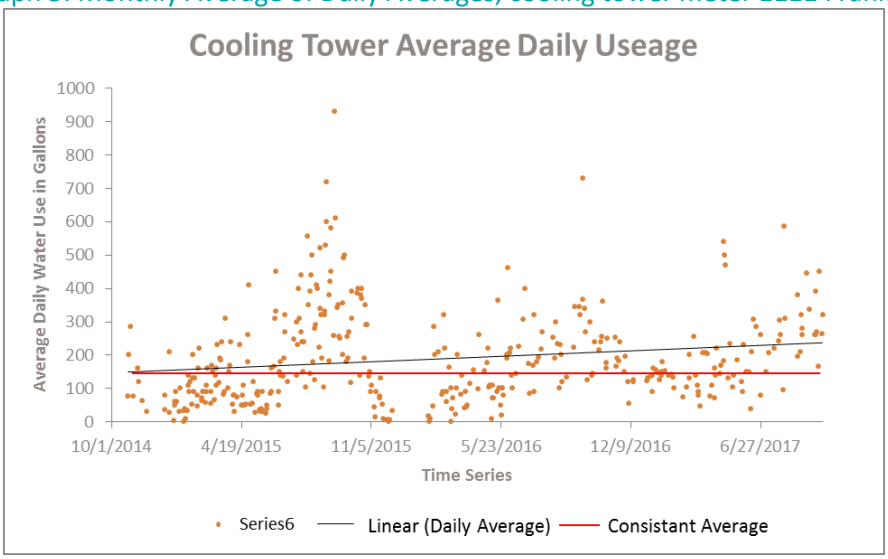
Graph 4 represents an average of daily averages within a given month.

Graph 4: Monthly Average of Daily Averages, Main Meter 1111 Franklin



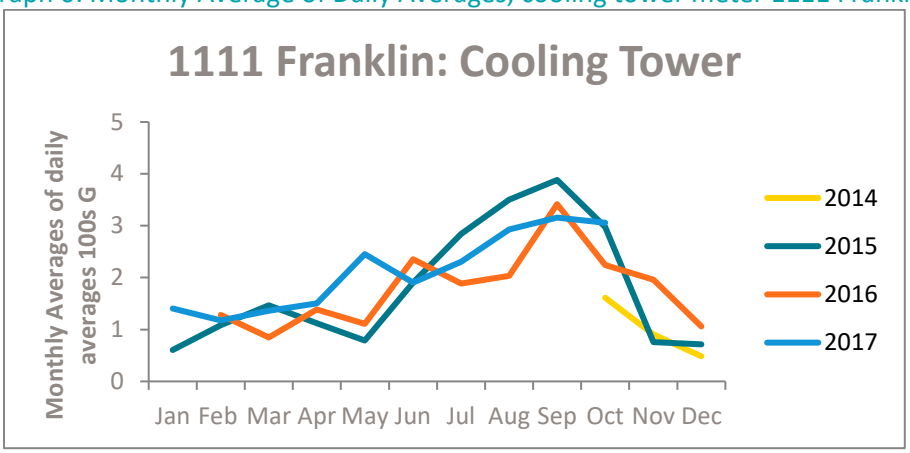
Graph 5 indicates peak use in summer months, with high usage in summer 2016.

Graph 5: Monthly Average of Daily Averages, cooling tower meter 1111 Franklin



Graph 5 demonstrates that daily averages in the cooling tower have tended to increase over-time, this increase is approximately 75 Gallons of water per day. The increased use in the cooling tower is significant, however, it does not account for all of the increase seen in the main meter.

Graph 6: Monthly Average of Daily Averages, cooling tower meter 1111 Franklin



The monthly averages of data shown in the line graph (graph 6) indicate a more irregular water use in 2016 in the warmer months between June and October. This is suggestive of a more efficient system and reflects the improvements undertaken to the cooling tower during 2015 and 2016. When taken together with the cooling tower scatter graph (5), this suggests that increases to daily average in the cooling tower may be attributable to weather rather than system inefficiencies.

This is supported by analysis of local weather data. While average temperatures for Oakland have not increased significantly from 2014-2017, maximum temperatures have been increasing, and the number of cooling degree days have almost doubled over the time period (Weather Underground, 2017).

3.5.Fixture Estimates

Using LEED indoor water use calculator's estimate of average usage of fixtures per day the average daily water use for fixtures at 1111 Franklin is estimated at 3282 Gallons/ day. See Appendix B for calculations (US Green Building Council, 2017).

3.6.Target Water Use

The target best practices range for water use is 4.2-17.7 CCF (CCF/kft2/yr), this equates to a total water use range of 1480-6250 CCF year. 2016-17 water use was 2867 or 8.1 CCF/kft2/yr.

4. Summary, Actions and Recommendations

In summary, water management at 1111 Franklin is within the best practice range and as such no major upgrades are needed to improve water outcomes. However, water use increases over the last few years suggest the potential for a leak. Best practice water management suggests logged water meters for different activity types, which suggests additional water meters be installed at the café and (lower priority) for the landscaped area on level 5.

In addition, for risk management purposes, real time loggers with alarms for high flow events are recommended. See Appendix E for details.

5. 1111 Franklin - Actions and Recommendations Water Savings Activities

Based on analysis of water meters readings it is plausible that the installation of an additional water meter and logger will identify a leak of up to 1300 G / day that can be addressed. There may be additional costs associated with addressing these leaks. It is worth noting that intermittent readings of water meters are non-conclusive and while best efforts have been made to determine water patterns, these findings are highly uncertain. However, based on a $7.44 /CCF fee, the cost savings have been estimated at $4,700/yr. Calculations do not include water heating costs as no data is available on hot water usage and water leaks are typically cold water leaks.

Incentives from EBMUD should be explored, however, current rebates will cease at year end 2017. Given the risk management benefits for real time data logging, funds for these systems can likely be sourced from the "Be Smart about Saftey Program". See Appendix E for more details.

Table 4: Water Actions for 1111 Franklin

Location:1111 Franklin Square foot: 353187 2016/17 Water Use: 2275 CCF Target water use: 1500 and 2000 CCF/ yr (or 4.2-5.6 (CCF/kft2/yr))						FTE: (2016/17): 802 WCU (2016/17): 601 Water Costs: $7.44/CCF See Appendix H for assumptions and calculation		
Action	One off Opex	Annual Opex	Addressable water use costs $	Annual Water Savings $	Simple Payback PV*	Net Present Value* ±	Target completion date	Responsibility
BAU			$16,926					
Install water meters and loggers ~~and reporting stickers~~	$7,550	$180		Potential $4,700	Potential 1.66 years	Potential $40K	June 30, 2018	UCOP Director of Buildings and Administrative Services

*Note Savings are not DIRECTLY attributable to actions.
± Assumes CPI at 3%, Discount rate at 5% and project life of 10 years

1111 Franklin: 2017 Recommendations in order of priority

1. Existing meters (main meter and cooling tower) should be connected to Lucid to collect pulse data for leak detection, and alerts should be set up for overnight flow and high water flow events for risk management. Funds for system set up and remove access valve shut down may be available from the "Be Smart About Safety" program. See Appendix D for further details on this recommendation.
2. The cafe on the ground floor should be sub-metered with a billing grade meter (also connected to a data logger and to existing software systems), and UCOP should consider moving away from all- in leases when preparing to renew the lease.
3. Install signage in all bathrooms informing users how to identify and report leaks, set up a system for collecting and responding to reports. See Appendix B for further details on this recommendation.
4. Retrofit the presidential bathroom and kitchen so that flow rates are consistent with Water Sense standards. Faucets should have aerators and a flow rate of 0.5gpm. The toilet should use 1.28 gallons per flush. The dishwasher replaced with an ENERGY STAR model. See Appendix C and Appendix E for further details on this recommendation.

1111 Franklin: 2019 Updates

1. Meters have been acquired and installed for both the cooling tower (replacement meter) and café water line (new meter). They have been incorporated into the Lucid system.
2. Signage has been installed in all bathrooms.

2017 Recommendations 1100 Broadway

1. Installed fixtures shall so be of the highest efficiency possible and Water Sense certified (if available) for a given application.
2. No sensor flushing should be used due to maintenance and water waste concerns.
3. Water meters must be inline installed (or compatible alternative approved by the client team) for hot water supply, cold water supply, as well as cooling tower make up water and bleed line. In addition, any outdoor landscaped areas must be sub-metered. Sub meters should be installed for the sewage discharge also if possible.
4. Any retail tenants should also be separately sub metered with billing grade meters.
5. Install filtered water taps with instant hot water at break-room sinks instead of standalone water coolers.

1100 Broadway: 2019 Updates

UCOP is in the process of constructing 1100 Broadway. Oakland based departments that are not currently housed in the 1111 Franklin building will be consolidated in this new building. As of March 2019, the construction plan includes the installation of one main EBMUD meter for all non-retail spaces with a sub meter for irrigation. Early estimates indicate that the addition of addition submeters would cost $150,000 total.

SECTION C: Washington D.C.

1. Local Context

Washington D.C.'s sustainability plan has outlined a number of water efficiency goals for its multi-family residential buildings. Washington D.C. aims to retrofit 100% of existing commercial and multi-family buildings to achieve net-zero energy and increase their water efficiency.

Public buildings will be retrofitted to achieve LEED Gold, and UCOP should use LEED EBOM water management guidance to address water management for buildings in Washington D.C. (Sustainable DC, 2013).

2. Facility Description

The UCDC building is an 11 story building with two parking levels and roof access. Floors 1-3 are dedicated to office and lecture space and floors 4-11 are primarily residential spaces, housing between 75 and 250 individuals every academic quarter, and five live in residential staff members who occupy the space during academic breaks. Two cooling towers are located on the roof.
Residential laundry rooms are located on floors 4, 6, and 10. Each laundry room contains a front-load washer along with three top loading washers and three dryers.

The gross floor area is approximately 159 k sq ft (plus parking). Approximately 80% of the occupied space is residential, with the other 20% being office/classroom space.

There is a main billing grade meter and a meter on the cooling tower make up water on site, neither are connected to data loggers or a monitoring system.

The number and type of water using fixtures and appliances at UCDC is outlined in the table below:

Table 5: Water Fixtures for UCDC

Fixture	Number
Full Bathroom (toilet, sink, shower)	94
Residential Kitchen (Kitchen sink)	81
Pantry Sink	6
Public toilet	22
Public urinal	6
Public bathroom sink	24
Hydration station	3
Water fountain	7
Cooling tower	2
Front loading Clothes Washer	3
Top loading clothes Washer	9

Table 6: Water Fixtures for UCDC

Fixture	Flow Rate	Notes
Toilet (public male)	1.60 gpf	
Toilet (public female)	1.60 gpf	
Toilet (residential male)	1.28 gpf	
Toilet (residential female)	1.28 gpf	
Urinal	1.00 gpf	
Public lavatory (restroom) faucet	1.50 gpm	UCDC plans to retrofit to meet WaterSense standards in 2018
Private (residential) lavatory faucet	1.50 gpm	Replaced between 2008 and 2015
Kitchen faucet	1.50 gpm	UCDC plans to retrofit to meet WaterSense standards in 2018
Showerhead	2.50 gpm	UCDC plans to retrofit to flow rate between 1.5 and 1.75 gpm in 2018
Cooling Towers	450 gpm	Maintenance done 2x a year

Figure 1: Typical UCDC Residential water fixtures (image figures 1 & 2 sourced from Sustainable Building Partners LII Audit of UCDC [v1.1])

Figure 2: Typical Laundry room

2.1. Occupancy

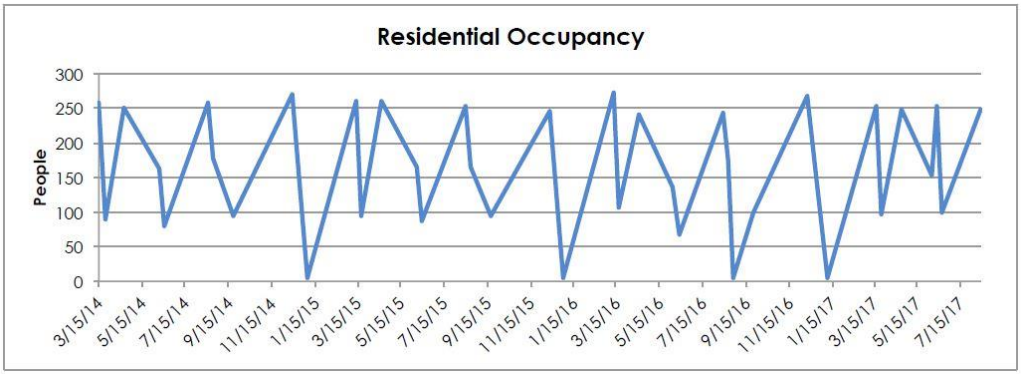
Residential spaces are operational and occupied 24/7

- 250 and 270 during fall, spring, and summer semesters

- 75-100 during breaks
- 5 staff residents during winter holidays

Annual occupancy for the purpose of this water plan was calculated by averaging the number of semester and quarter students present each quarter for the academic year.

Graph 7: Residential Occupancy 3/14-7/17 (
sourced from Sustainable Building Partners LII Audit of UCDC [v1.1])



3. Water Use Analysis

3.1. Comparison to Best Practice Benchmarks

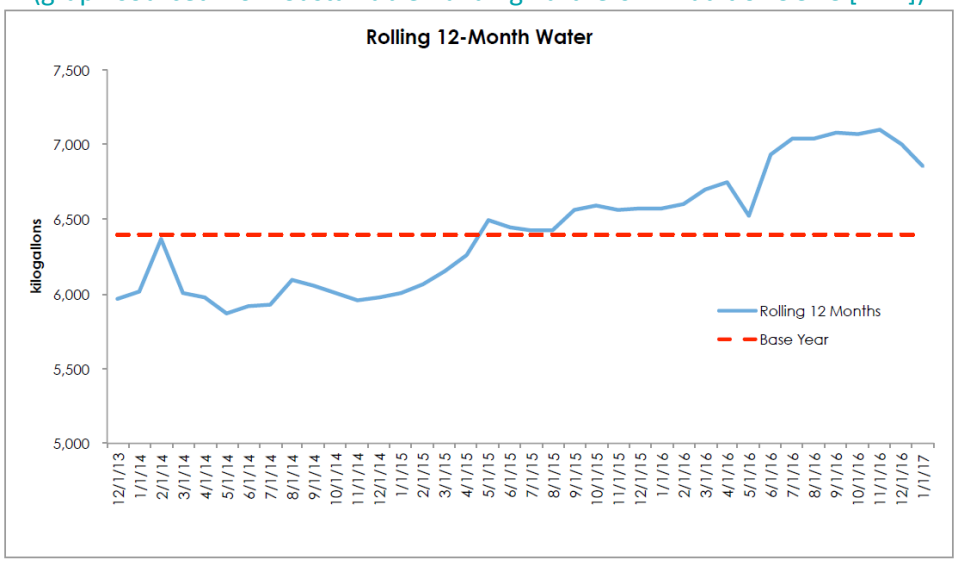
Table 10 outlines the comparison of UCDCs operations compared to the best practice benchmarks presented in section 2.3. UCDC is a mixed use building, as such, the benchmark is expressed as a "whole building" (rather than a CCF per wcu or per sq ft).

Table 7: Best Practice Benchmarks UCDC

Building	2015-16 Water Use (CCF/wcu/year)	2016-17 Water Use (CCF/wcu/year)	Best Practice Range (CCF/wcu/year)
UCDC	9462	7298	4419-5421

3.2.Time Series Data

Graph 8: Rolling 12 Month Water Use
(graph sourced from Sustainable Building Partners LII Audit of UCDC [v1.1])



It appears that water use has increased by 500- 1000 kilogallons (670-1135 CCF) over the time period analyzed.. Comparing water use numbers with the occupancy expressed in graph 8, there is significant water use increases in a period in which occupancy has not changed significantly. Some change can be explained by weather. From 2013 to the end of 2016, average summer temperatures in Washington D.C. have increased from 78.3 degrees to 80.5 degrees. The number of annual cooling degree days has also been on the rise. There were 1994 cooling degree days in 2016, which represents a marked increase from 2013's 1719 cooling degree days (xmACIS2, 2017).

3.3.Planned activities

UCDC commissioned Sustainable Building Partners to undertake an LII energy audit of their space.

In the draft report, retrofitting showers and kitchen faucets has been recommended as a measure to reduce both energy and water costs. The draft report recommends flow rates of 1.75 gpm for showers and 1.5 gpm for kitchen faucets.

The audit estimates a material cost of $2,700 for these upgrades (76 shower heads at $25 each, 160 Aerators at $5 each, labor provided within existing maintenance contracts, at no additional cost). Estimated savings from these measure is 600,000 G (802 CCF) of water per year. More accurate estimates of $1635 were sourced from the building manager.

3.4. Water Fixture Use Estimates and Planned activities

Based on limitations to available data, estimates on water use opportunities through fixture retrofits have been made using the LEED indoor water use assumptions (source). This was achieved through the four modelled scenarios in table 11.

Table 8: Water Savings Estimates based water fixture retro-fits scenarios

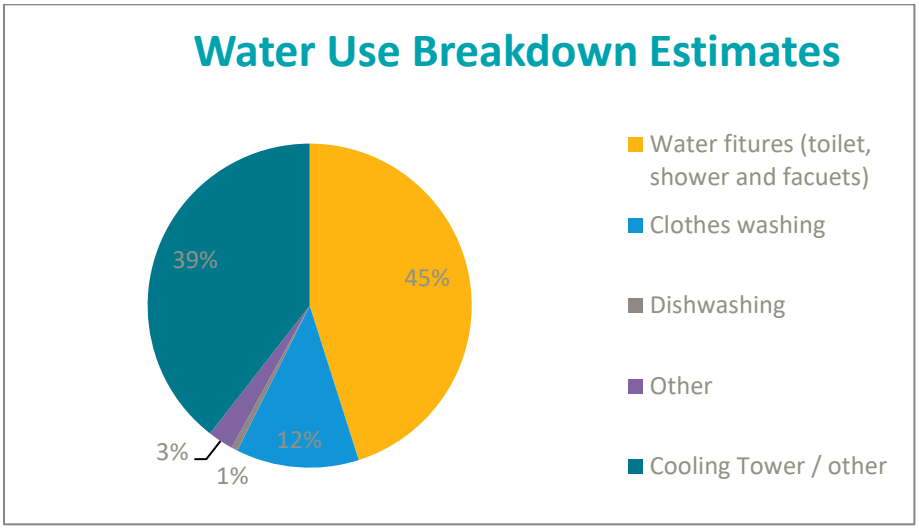
	Water Fixture Estimate (CCF/yr)	Savings against baseline (CCF/yr)
Water fixture use estimates with current fixture flow rates (Business as Usual Assumptions)	3779	NA
Water fixture use estimates with measures recommended in energy audit at a lower flow rate than recommended (showerheads at 1.5 gpm and kitchen faucets .5 gpm)	2665	1115
Water fixture use estimates with measures recommended in energy audit at a lower flow rate than recommended (showerheads at 1.5 gpm and kitchen faucets .5 gpm) AND the installation of flow restrictors in lavatories to 0.5	2184	1608
Water fixture use estimates for all fixtures using the lowest flow rate of the planned and or water sense recommended flow rates	2171	1595

These calculations assume occupancy of 22 weeks a year with current office (32 FTE, 55% female, 45% male) and residential occupancy (223 residents). See Appendix A for detailed calculations and assumptions.

3.5. Water Use Breakdown Estimates

Based on the calculations above (an estimate of ~3780 CFF from fixtures), using residential estimates from DeOreo et al (2015) and using an average of the last few years of total water use at UCDC (2015/16 : 9462 CCF and 206/17 - 7298 CCF), the portion of water use attributable to cooling towers, car park cleaning and other minor uses is about 33% of the total. This figure was obtained by subtracting estimated water in other categories from the average water use in 2015/16.

Graph 9: UCDC Water Use Broken Down by Type



Typical residential water use benchmarks do not include facilities with central plants and cooling towers. Based on EPAs office benchmarks (EPA 2016), cooling and heating is typically about 36% of the total water use in an office building (excluding leaks). Residential water use is much higher per person than office water use, including both showers (approximately 20% of residential use – excluding cooling and heating) and washing (approximately 19% - excluding cooling and heating) (DeOreo et al 2015), so the proportion of water use allocated to cooling towers and "other" would be expected to be lower than that in office buildings. As such, at 39% the estimated proportion of "cooling tower and other" water use is higher than expected for a building with residential water use and taken with increases to water use is worth further investigation.

3.6. Target Water Use

As UCDC is centrally cooled, a target water use for this site has been selected at the highest level of the best practice range calculated for building. A 10% +/- on the upper level of this range would provide a target range of 4900-6000 CCF/yr.

4. Summary

As a primary residential site, there are significant opportunities for water savings at UCDC from water fixture upgrades. Faucet and shower upgrades will save water immediately at low cost and minimal effort.

While the available data is insufficient to determine if there is any leakage, there is some evidence that suggests a possible leak. Water use at UCDC has gone up significantly over the last few years with no increase in occupancy. In addition, benchmarking indicates total water use is somewhat higher than should be expected given the current water fixtures, plant and equipment. The installation of a data logger on the main water meter and the cooling tower make up water will help to identify if there is a leak, at which time further investigation will be required.

Given that UCDC is already using Buildings Alive, sending the data to buildings alive for analysis (which can be done for no additional service fee) is a sensible first step in identifying whether or not there is a leak in the building currently, as well as identifying leaks over time. Consideration should be given to an additional data logger for the cooling tower make up water at this time.

Unlike Lucid, Buildings Alive offers only post analysis of data, as such, while it will allow analysis of water use and identification of base flow (leaks), it will not facilitate alarms. Best practice for risk management and prevention of flooding damage would suggest the inclusion of a real time analysis tool in the building. This should be undertaken should funds for this activity be available from the UC Be Smart about Safety Program.

5. Water Actions and Recommendations UCDC

Table 9: Water Actions UCDC

Location: Rhode Island Ave NW, Washington, DC Square foot: 158389 (excluding car park) 2016/17 Water Use: 7298 CCF Target water use: 4900-6000 CCF/yr	WCU (2016/17): 246.73 Water Costs: $12.34/CCF See Appendix H for assumptions and calculation

Action	One off Opex	Annual Opex	Addressable water use costs $	Annual Savings $	Simple Payback PV	Net Present Value ±	Target completion date	Responsibility
BAU			$73,052					
~~Water Fixture Upgrades: residential Kitchen and shower~~	~~$1653~~	~~$0~~		~~$14800 ($13,000 water utilities, $1800 Gas)~~	~~Potential .1 years~~	~~Potential $107K~~	~~Jan/Feb 2018~~	~~Manager, Building and Housing Services UC Washington Center~~
~~Water Fixture Upgrades: bathroom~~	~~$470~~	~~$0~~		~~$11,000 ($9,500 water utilities, $1500 Gas Utilities)~~	~~Potential .04 years~~	~~Potential $80K~~	~~Jan/Feb 2018~~	~~Manager, Building and Housing Services UC Washington Center~~
Data Logger Installation main meter and cooling tower meter	$3,300	$180		No direct or calculable savings though chance of locating a leak through system is fair.			June 2018	Manager, Building and Housing Services UC Washington Center

Water Savings and Reporting Stickers	$300	$100*		No direct or calculable savings.			June 2018	Manager, Building and Housing Services UC Washington Center
Connection of water logger to live metering and alarm (funds to be sought from Be Smart about Safety)	$500	$1,200		No direct or calculable savings.			June 2018	Manager, Building and Housing Services UC Washington Center

± Assumes CPI at 3%, Discount rate at 5% and project life of 10 years

*Assumes replacement of 30% of stickers per year

UCDC: Recommendations in order of priority

1. Planned retrofits should be completed in 2018, and include residential bathroom faucet air raters. Restroom sinks should have a flow rate of 0.5gpm, kitchen sinks 0.5-1gpm and showerheads should flow at 1.5gpm
2. A data logger should be connected to the main meter at minimum and the cooling tower make up water. The data meter should be set up to send data to buildings alive. Daily email alerts will provide sufficient information to determine if there is a base flow of water (a leak) or unexpected high usage. Analysis of this data will indicate whether or not further meters are justified.
3. Should funds be available from “Be Smart About Safety” systems should also be integrated into a live system such with remote value shut off capabilities, which will allow for high flow alarms to reduce the risk of flood damage.
4. Signage should be posted in residential bathrooms encouraging residents to limit their shower times (see Appendix C)

2019 updates

UCDC installed the .5gpm and 1.5gpm aerators in all residential units.

Section D: Mexico City

1. Local Context

The amount of water available to each resident of Mexico City has decreased significantly due to declining water supply and increasing population. Climate change is expected to increase water supply uncertainty and demand in Mexico City. Water shortages and lack of wastewater recycling and rainwater collection have led to deeper drilling for water, causing subsidence and sinking of the city itself. Decreasing water usage will help place less of a strain on Mexico City's increasingly scarce water resources (Kimmelman, 2017)[i].

2. Facility: La Casa

Casa de California is a property owned and managed by UCOP in Mexico City. UC occupies one of the four buildings on the property. The space is used for meetings organized by UC alumni or affiliates and the UC Education Abroad program in Mexico. The other three building are leased to tenants, but all buildings as well as the grounds are on the same water meter.

There are no water meters other than the main water meter.

3. La Casa Water Use Equipment/Activities

La Casa is a landscaped area with a fountain, water use in this facility consists of domestic uses (restrooms and kitchens), landscaping and fountains. New cooling systems have been installed, but they are not water cooled. The site contains four buildings, only one is occupied by UCOP, the other three are tenanted; however all of the water usage onsite is under UCOP financial control.

La Casa is one of two UCOP sites with irrigated turf, but the only one with running fountains. An estimate of 19,558 sq ft of landscaping has been made using property plans. This area contains both trees and turf as well as two fountains.

Figure 3 outdoor reception space / Fountain

4. Occupancy

There are three UCOP staff members who occupy the UCOP owned building (La Casona) 5 days a week. There are approximately 75 FTE employees across all four buildings who are present on average 5 days a week. The number of water users varies with events held on site.

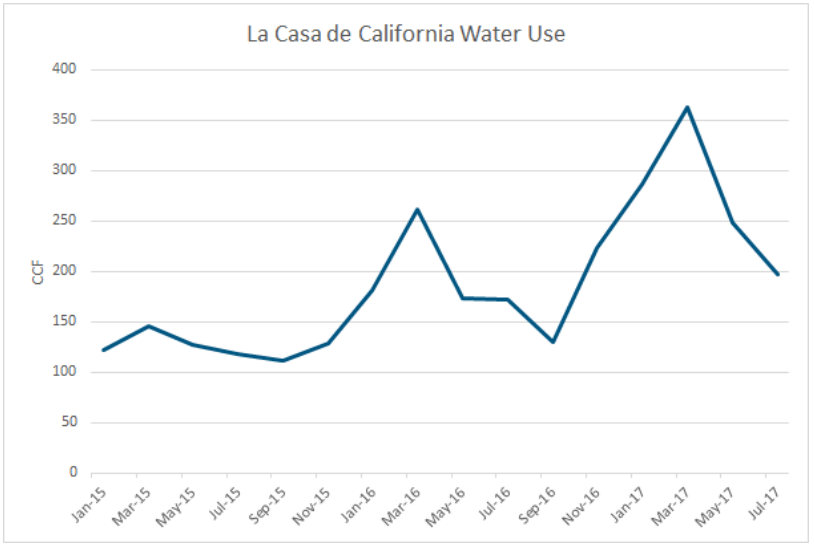
There is only one water meter for all four buildings at La Casa despite there being distinct tenants in each one.

5. La Casa de California Water Use Analysis

Building	2015-16 Water Use (CCF/kft^2/yr)	2016-17 Water Use (CCF/kft^2/yr)	2017-18 Water Use (CCF/kft^2/yr)	Best Practice Range (CCF/kft^2/yr)
La Casa	32.3	47.2	41.3	4.2-17.7

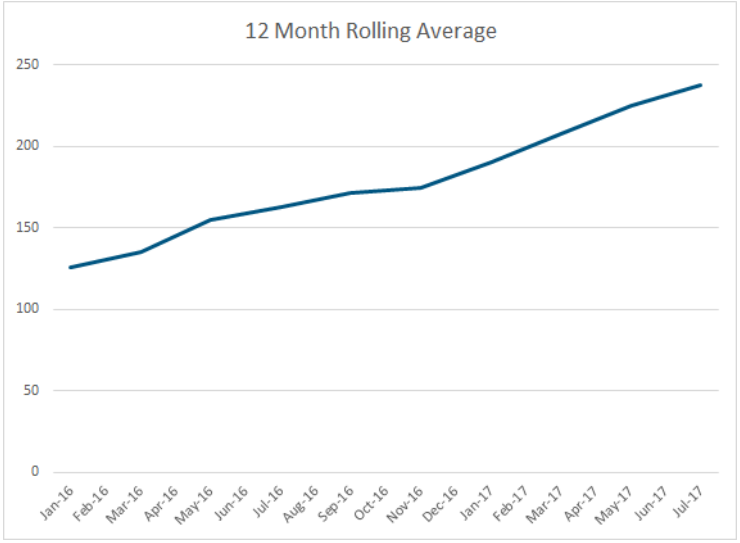
La Casa's water use exceeds the best practice range and has been increasing overall. The higher water usage can probably be attributed to the water intensive landscaping and fountains found on site. The above water usage is calculated over both building and landscape square footage.

Graph 10 La Casa De California Water Use, data sourced from water bill data in Energy Cap



Graph 10 shows overall water use for La Casa between January 2015 and July 2017. The peaks in the graph correspond with the dry season in the city, which calls for higher water use to maintain landscaping. While there appears to be a large drop in water use for the July 2017 billing cycle, it should be taken into account that July falls in Mexico City's rainy season, and July 2017 water usage is significantly higher than July water usage for previous years, and has grown from year to year. The peak water usage has also been increasing each year as well despite there being larger average and total rainfall in 2017 than in previous years (Weather Underground, 2017b).

Graph 11: La Casa De California Water Use,
12 month rolling average, data sourced from water bill data in Energy Cap



The twelve month rolling average graph shows an upward trend in water usage over the past year and a half. The upward trend could be a result of an undetected leak or higher use and maintenance of the facility. A logging meter would help detect where increases in water use are occurring and allow for a more targeted response to increase water efficiency at the site.

6. Summary

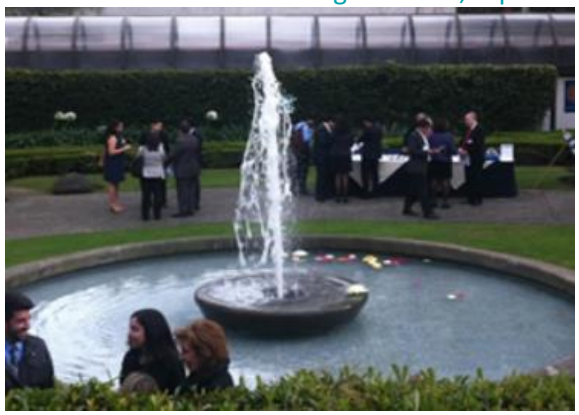
In summary, La Casa de California's water use is both above the best practice range and increasing, which presents a number of opportunities to reduce water usage at this location.

While more information needs to be gathered on fixtures, appliances, and other water using activities to give a comprehensive set of recommendations for La Casa, general recommendations are provided for low cost fixture upgrades, watering frequency, data logging and a suggestion for changes to the fountains.

7. Recommendations in Order of Priority

1. Watering schedules should be examined. It is recommended that watering no more than 3 times weekly for 15 mins during dusk or at night be tested.
2. Logging meters should be installed on the main water meter. See Appendix D for further details on this recommendation.
3. At a minimum faucets and showers on the property should be updated to meet LEED and WaterSense standards, more detail, including costs and savings on this recommendation will be provided after more information on the number and types of fixtures currently present at the site are gathered.
4. Install signage in all bathrooms informing users how to identify and report leaks, set up a system for collecting and responding to reports. See Appendix B and Appendix F for further details on this recommendation.
5. Consideration should be given to re-purposing the fountains at La Casa (see figures 4-10 for example).
6. Consideration should be given to sub- metering the three buildings not occupied by UCOP eventually moving them off an all in lease.

Figures 4-10, top left - existing fountain; examples of repurposed fountains



SECTION E: Riverside (UCPath)

1. Local Context

Riverside California constantly deals with water supply problems that result from drought and regulations. Riverside is still in a Stage 2 Water Supply Alert, which calls for reductions in water use and prohibits landscape water runoff. Due to regular water shortages, Western Municipal Water District, which serves the UCPath Center, purchases and imports water from other often water strapped water districts in the area. Being a more efficient water user can increase available water supply for the greater Riverside community, and alleviate the demand placed on Southern California Water Utilities. More efficient users are also more easily able to adapt to restrictions put in place to reduce consumption during drought years (Western Municipal Water District, 2015).

SoCal Water Smart also operates a Water Savings Incentive Program (WSIP) for commercial customers. The program provides incentives for equipment or services that standard rebates may not cover based on the amount of water saved. To be eligible, a project must save a minimum of 10,000,000 gallons of water over a 10 year period. For context, UCPath's total water use in 2016/17 was less than 20% of this number. There are also a number of rebates available to commercial water customers which include high efficiency and zero water toilets and urinals, irrigation controllers, nozzles for pop-up spray heads, soil moisture sensor systems, in-stem flow regulators, air cooled ice machines, and for improvements made to HVAC systems. (SoCal Water Smart, 2017).

2. Facility Description

UCPath is a three story building, the second floor (53,184 sq ft) is unoccupied, but has water fixtures that are used by staff. Floors are separated into North and South wings. The building was constructed in 2013, is a LEED Gold building, and has no cooling towers. All fixtures in the building currently meet or exceed the LEED/WaterSense benchmarks set at the time they were installed.

There are strips of landscaped areas around the perimeter of both the building itself and the property. Using a Google Maps measurement tool (Google Maps, 2017), the area of this landscaped area was estimated to be 13,855 sq ft.

2.1. Water Use Equipment/Activity Breakdown

Floor	Water Fixtures and Appliances

1st Floor North Wing	• Women's Restroom: 3 stalls, 1 sink • Men's Restroom: 2 stalls, 1 urinal, 1 sink • Breakroom: 1 standalone water dispenser, 2 water and ice dispensing refrigerators, 1 sink • Other: 1 dual water fountain
1st Floor South Wing	• Women's Restroom: 7 stalls, 3 sinks • Men's Restroom: 4 stalls, 3 urinals, 3 sinks • Breakroom: 2 sinks, 1 countertop water and ice dispenser • Other: 1 dual water fountain
2nd Floor North Wing	• Women's Restroom: 3 stalls, 1 sink • Men's Restroom: 2 stalls, 1 urinal, 1 sink • Other: 1 dual water fountain
2nd Floor South Wing	• Women's Restroom: 3 stalls, 1 sink • Men's Restroom: 2 stalls, 1 urinal, 1 sink • Other: 1 dual water fountain
3rd Floor North Wing	• Women's Restroom: 7 stalls, 3 sinks • Men's Restroom: 2 stalls, 1 urinal, 2 sinks • Breakroom: 1 sink, 1 dishwasher, 1 standalone water dispenser, 1 water and ice dispensing refrigerator • Other: 1 dual water fountain
3rd Floor South Wing	• Women's Restroom: 7 stalls, 3 sinks • Men's Restroom: 2 stalls, 1 urinal, 2 sinks • Breakroom: 1 sink, 1 dishwasher, 1 water and ice dispensing refrigerator, 5 countertop water and ice dispenser (throughout floor)

	• Other: 1 dual water fountain, 5 restaurant style coffeemakers

Table 10: List of Fixtures and Appliances at UCPath

1st Floor	Flow rate
Toilet (women's)	1.6 gpf
Toilet (men's)	1.6 gpf
Urinal	1.0 gpf
Public lavatory (restroom) faucet	0.5 gpm (North), 0.35 gpm (South)
Kitchen faucet	1.5 gpm
Showerhead	1.5 gpm
2nd Floor	**Flow rate**
Toilet (women's)	1.6 gpf
Toilet (men's)	1.6 gpf
Urinal	1.0 gpf
Kitchen faucet	0.5 gpm
3rd Floor	**Flow rate**
Toilet (women's)	1.1 gpf (8), 1.6 gpf (6)
Toilet (men's)	1.6 gpf
Urinal	0.125 gpf
Public lavatory (restroom) faucet	0.35 gpm

2.2.Occupancy

As of 2016, the building had an occupancy of 232 individuals (after recent growth occupancy was inventoried as 502 in December 2017) who are at the site 5.5 days a week. In 2019, there were approximately 625 occupants in the building. Projected full occupancy is estimated to be approximately 940 when the remaining 25,000 square feet is fully developed.

3. Water Use Analysis

3.1. Potable Water

As of 2019, current building occupants have been receiving their potable water from countertop water dispensers and ice makers from a third party vendor, CANTEEN, or through refrigerator appliances.

3.2. Landscaping and Irrigation

As noted above, there are strips of landscaped areas around the building and property, the area of this landscaped area was estimated to be 13,855 sq ft.

UCPath removed a number of landscaped islands in 2017 as part of a car park solar project. These were:

- 6 islands at 7 ft x 36 ft - 1,512 sq ft
- 7 islands at 8 ft x 36 ft - 2,034 sq ft
- 7 islands at 10 ft x 36 ft - 2,520 sq ft

In addition UCPath Decreased watering from 30 mins per week day to 15 mins every three days. Watering is undertaken at dusk and occasionally at dawn.

Irrigation water at UCPath has shifted from predominantly potable to predominantly non –potable in the 2016/2017 period.

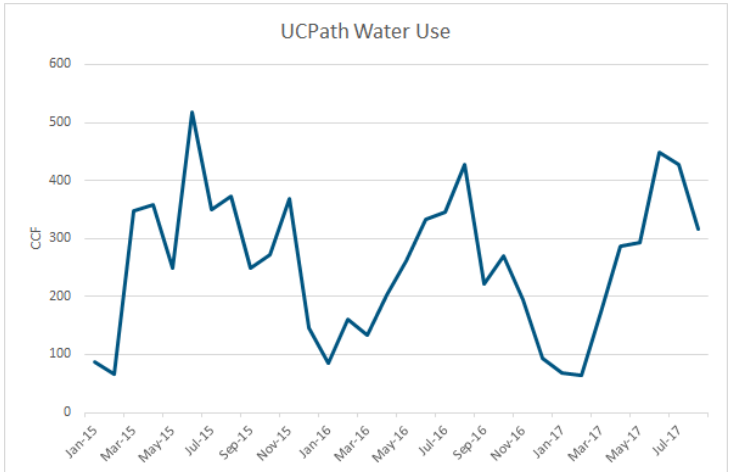
4. Comparison to Best Practice Benchmarks

UCPath is a newer building, and had water efficient fixtures installed upon construction. Its combined (potable and non-potable) water use is outside of the best practice range, which is expected given low occupancy.

Building	2015-16 Water Use (CCF/kft^2/yr)	2016-17 Water Use (CCF/kft^2/yr)	2017-18 Water Use (CCF/kft^2/yr)	Best Practice Range (CCF/kft^2/yr)

UCPath	18.3	18.2	24.4	4.2-17.7

Graph 13: UCPath Water Use (potable and non-potable) (Data Source- Water Bills in EnergyCAP)



Graph 13 shows total water use by the UCPath center. The peaks in water use correspond with the hotter summer months, when the HVAC system is using more water to keep the building cool, and more water may be required to maintain landscaping.

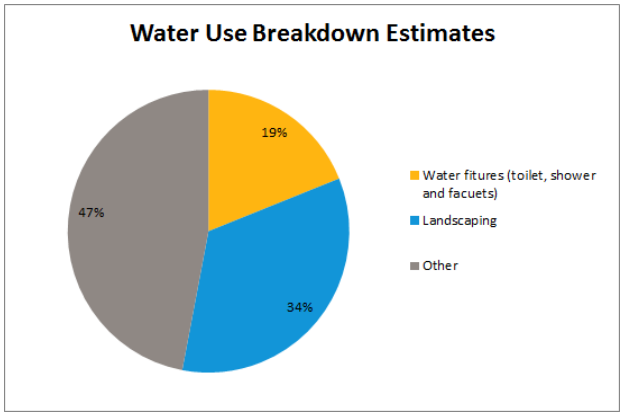
Table 11: Estimated Water Use by fixtures at UCPath

Fixture Type	Maximum Installed Flush/Flow Rate IP	Duration Mins	Default Uses per Day Employees (FTE)	FTE	Total Water Use
Toilet (male)	1.6 gpf	n/a	1	77	123

Toilet (female)	1.6 gpf	n/a	2.25	191	688
Toilet (female)	1.1 gpf	n/a	0.75	191	158
Urinal	1 gpf	n/a	1.33	77	102
Urinal	0.125 gpf	n/a	0.67	77	6
Public lavatory (restroom) faucet	0.5 gpm	0.5	0.75	268	50
Public lavatory (restroom) faucet	0.35 gpm	0.5	0.75	268	35
Kitchen faucet	1.5 gpm	0.25	1	268	101
Showerhead	1.5 gpm	5	0.1	268	201
Total Water Use from Fixtures (in gallons per day)					1464
Total Water Use from Fixtures (in Gallons per year)					374093
Total Water Use from Fixtures (in CCF per year)					500

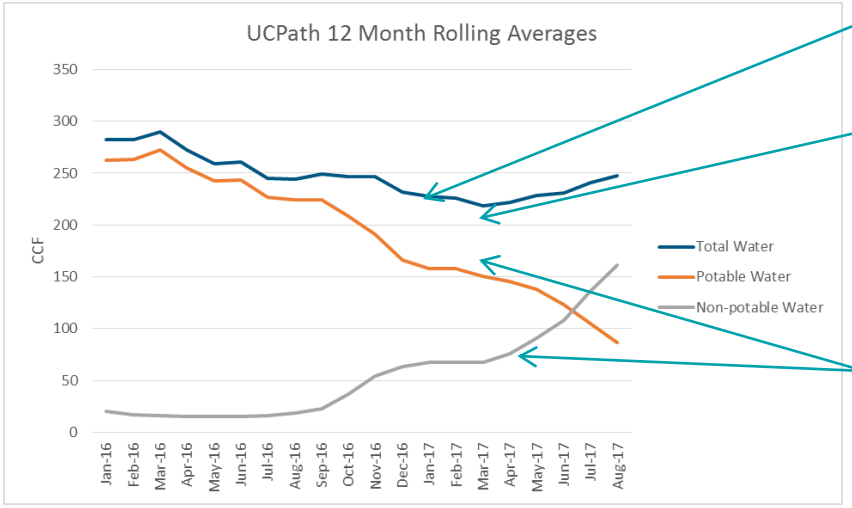
Table 14 shows the estimated total water use from fixtures at UCPath to be 500 CCF per year, which accounts for approximately 20% of UCPath's total water use. The EPA's Office Benchmarks state that 50% of a building's total water consumption is used by fixtures in the building (EPA, 2016). UCPath's 20% is significantly lower than this figure which represents efficient fixtures and / or high usage for some other activities. Retrofitting the toilets that do not meet WaterSense standards would not result in significant water saving for the center and will not be recommended as an action due to the low water costs at Riverside, but may be considered.

Graph 14: Breakdown of UCPath Water Use



Analysis of UCPath's water usage shows the largest proportion of water going to the 'Other' category and to landscaping. This could is likely due to a growing population not reflected in fixture use estimates

Graph 15: 12 Month Rolling Average of UCPath Wat
(Source-WMWD Water Bills in EnergyCAP)



Decline in water use due to changed watering schedules

Dip in total water use due to removal of landscaped areas

Shift of landscaping from mostly potable to mostly non-potable water

Overall, there appears to be a downward trend in gross and normalized water usage despite a growing staff. In addition, water use has shifted to from predominantly potable to predominantly non potable. The impact of removing the landscaped islands and reduction of the number of

watering days and length of watering is evidenced in decline in use. Installing loggers can provide more information on how water is used at UCPath and help staff target higher water use activities more effectively as well as identify leaks. The small and decreasing percentage of potable water use suggests that the bulk of the site's water is use for landscaping.

5. Water Costs

Facilities at Western Municipal Water District are given a monthly water budget according to three year monthly averages. UCPath's actual water usage is billed using a tiered structure. The tiers are as follows: Tier 1- 90% of average past use of that month over past 3 years billed at $1.978 per CCF, Tier 2 water is based on the remaining 10% of average past use of that month billed at $2.306 per CCF, Tier 3 water is based on exceeding the water budget by up to 25% and is billed at $2.849 per CCF, Tier 4 water is based on exceeding the water budget by 25-50% and is billed at $4.424 per CCF, and Tier 5 water is all water exceeding the budget more than 50%. The UCPath Center has regularly been operating in this zone.

Non-potable water is $1.27 a CCF.

Wastewater costs at UC Riverside are negotiated and based on estimated water use calculated from equivalent dwelling units rather than metered readings. Wastewater savings measures under this sort of a billing arrangement will not provide returns.

The key item to note with regards to UCPath's water costs is that they are extremely low compared to other UCOP sites.

6. Summary

Despite a growing population, UCPath's water use has decreased generally and specifically potable water use has decreased dramatically. The proportion of UCPath's water used in landscaping is extremely high, which speaks to an efficient building and the switch from using potable to non-potable water and reducing irrigation is considered good practice. Overall water use fell outside of the best practice range due to low occupancy, which is expected. The data should be reexamined once the site reaches full occupancy.

Consideration could be given to reducing the flush in toilets, though this should be done cautiously as changing flushes without switching out commodes can result in higher water use (see Appendix E for details).

This general success of water savings to date at UCPath, combined with the low water costs per unit in Riverside mean there are no water savings activities recommended. This should also be reevaluated once UCPath reaches full occupancy.

As with other sites, funding for data logging, alarms and remote shut of valves through the Smart about Savings Program should be investigated.

7. Summary of General Information and Recommendations

Summary of General Information
Location: 14350 Meridian Parkway, Riverside
Square foot: Occupied: 105,860 Unoccupied: 53,184 (excluding car park)
2016/17 Water Use: 2642 CCF
Target water use: 4.2-17.7 (CCF/kft2/yr) (to be resolved when fully occupied)

Despite a lack of cost savings to be gained at UCPath through water savings due to efficient systems and low per unit water costs, the following are recommended best practices to be explored:

1. Install loggers on the main water meter to enable future analysis of water use and detect leaks. These should be contacted to Buildings Alive service that can be achieved with no additional service costs. Cost
2. As with other sites, funding for data logging, alarms and remote shut of valves through the Smart about Savings Program should be investigated.
3. Install signage in all bathrooms informing users how to identify and report leaks, set up a system for collecting and responding to reports. See Appendix E for further details on this recommendation.

2019 Updates

Employees can report leaks by either sending an email to the Building Manager or by placing an iRequest work order. An on-site building engineer, will then be dispatched to triage and repair the issue.

[i] Michael Kimmelman (2017). Mexico City, Parched and Sinking Faces a Water Crisis
https://www.nytimes.com/interactive/2017/02/17/world/americas/mexico-city-sinking.html