

Water Benchmark Report 2002-2013



Sustainability House
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Overview

This project aims to track, pinpoint, and summarize water usage on the University of Arkansas campus beginning with the year 2002 and continuing through 2013. The water usage data are classified into three main categories: Irrigation, Building Usage, and Central Utilities. The data are then subcategorized into more specific groups, which will be further discussed below. The goal of this analysis is for the Office for Sustainability to benchmark water usage by category, see where efforts for water conservation are most needed, and to track the progress of these conservation initiatives over time.

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Methods

The water usage categories were defined as follows:

1. Irrigation
 - a. 1 - Athletic Playing/Practice Fields
 - b. 2 - Intramural Fields
 - c. 3 - Fields on Campus
2. Building Usage
 - a. 4 - Housing – Dorms/Greek
 - b. 5 - Dining Halls
 - c. 6 - Academic/Administration Buildings
 - d. 7 - Recreation/Athletics
 - e. 8 - Other (facilities, storage, warehouses, etc.)

3. Central Utilities
 - a. Central Chiller Plant – CCHP
 - b. North Chiller Plant – NCHL
 - c. South West Chiller Plant – SWCP
 - d. Heating Plant – HEAT

To ensure consistency for each year, it was necessary to create a list of all buildings and water meters that are used by the University of Arkansas and assign them a water usage category. This list includes off-campus buildings such as research buildings and Uptown Campus buildings. The categories were assigned numbers 1-8 (from above) according to a list of buildings provided by Kevin E. Santos. Those that were not listed were categorized using Google Maps and the UA campus map. The final inventory with building number, address, building name or description, building code, and water usage category are archived on the University of Arkansas server, and summarized in Table 1.

Table 1. An Example of Water Classification of University of Arkansas Buildings

#	Address	Building	Code	Water Classification
1	2 N. East Ave.	Campus on Square	CTED	6
2	16 S. Duncan	unknown	UANS	6
4	449 S. Garland Ave. IRG (Wms soccer)			1
5	449 S. Garland Ave. (Wms' soccer)		SRDA	7
6	1330 W. 6th St. IRG	gardens		3
7	1175 W. Leroy Pond Dr.	irrigation	CARL	3
8	10 S. Razorback Rd.	track consessions	TRPA	7
10	108 N. Razorback Rd.	softball ballpark irr?	SOBP	1
11	350 N. Razorback Rd. (W. STAD)	stadium w. skybox	RSWE	7
12	606 N. Razorback Rd.	health - Eply center	HLTH	6
14	1175 W. Cleveland	Hotz hall	HOTZ	6
15	1120 W. Maple St.	agriculture	AFLS	6
16	1120 W. Maple St. IRG	irrigation	AFLS	3

This list was used as a reference to consistently categorize total water usage per building or water meter listed in the annual water bills for fiscal years 2002-2013, provided by Jeffrey E. Siebler. The values of total water usage per building were summed for each corresponding water usage category to find total water usage per category per year. The data was also normalized to find trends of water usage per person and per gross square foot in order to account for these variables. A portion (2012 and 2013 data) of the final summary is presented in Table 2.

Table2. Comparative University of Arkansas Water Use by Category, 2012-2013

	2012			2013		
	Amount (gallons)	Cost	%	Amount (gallons)	Cost	%
Irrigation						
1 - Athletic Playing/Practice Fields	8,852,800	\$ 31,870.08	27%	7,213,300	\$ 25,967.88	26%
2 - Intramural Fields	5,900	\$ 21.24	0%	6,200	\$ 22.32	0%
3 - Fields on Campus	23,723,000	\$ 85,402.80	73%	20,085,600	\$ 72,308.16	74%
TOTAL	32,581,700	\$ 117,294.12	14%	27,305,100	\$ 98,298.36	12%
Building Usage						
4 - Housing - Dorms/Greek	64,569,178	\$ 232,449.04	48%	59,842,596	\$ 215,433.35	43%
5 - Dining Halls	10,358,422	\$ 37,290.32	8%	10,978,704	\$ 39,523.33	8%
6 - Academic/Admin. Buildings	24,891,700	\$ 89,610.12	18%	26,476,550	\$ 95,315.58	19%
7 - Recreation/Athletics	26,028,100	\$ 93,701.16	19%	31,184,400	\$ 112,263.84	22%
8 - Other (facilities, etc.)	9,155,600	\$ 32,960.16	7%	11,945,700	\$ 43,004.52	9%
TOTAL	135,003,000	\$ 486,010.80	58%	140,427,950	\$ 505,540.62	61%
Central Utilities						
CCHP -chiller plant	36,386,800	\$ 130,992.48	55%	33,943,300	\$ 122,195.88	53%
NCHL - chiller plant	2,054,000	\$ 7,394.40	3%	2,507,500	\$ 9,027.00	4%
SWCP - chiller plant	17,583,700	\$ 63,301.32	27%	16,466,700	\$ 59,280.12	26%
HEAT - heating plant	9,588,700	\$ 34,519.32	15%	11,430,200	\$ 41,148.72	18%
TOTAL	65,613,200	\$ 236,207.52	28%	64,347,700	\$ 231,651.72	28%
TOTAL WATER USAGE (gallons)	230,883,700	\$ 1,594,905.16		228,910,450	\$ 1,928,658.26	
	233,197,900	\$ 839,512.44		232,080,750	\$ 835,490.70	
Normalization Data						
Total GSF in Footprint (GSF)	7,731,036			7,807,144		
Total Enrollment (FTE)	21,242			22,225		
Total Faculty and Staff (FTE)	4,638			4,767		
TOTAL POPULATION	25,880			26,992		
Summary						
Water Usage (Gal/Capita)	8,921			8,481		
Water Usage (Gal/GSF)	30			29		

The Total Water Usage (gallons) has two values listed to account for error. The top one is the value given and calculated electronically by the water bill spreadsheets and the value below is the actual sum of the values listed above which were entered manually. The average error was 0.37 percent for years 2002-2013. Percentages were calculated using

the bottom number. The spreadsheet, which includes years 2002-2013, is archived on the University of Arkansas Office for Sustainability server.

Using this system of assigning water usage category numbers to each building and water meter ensured that each building for every year was counted under the same category for water usage. Entering data manually was not only necessary in order to categorize each building from the water bills, but also addressed translational challenges such as invalid reference cells in the spreadsheets.

Summary of Data

The amount and distribution of water usage on campus is fairly consistent over time (Figure 1). The majority of the water is being used in buildings, slightly less in heating and cooling, while the least is being used for irrigation (Figure 2). Variations in total usage can be attributed to years of drought, changes in irrigation patterns, construction periods, or even errors in record entry from earlier years. Taking a closer look at irrigation patterns, one can see significantly less water being used for irrigation after 2007 up until 2012 (Figure 2). This drop is explained by the implementation of drip irrigation beginning around 2006 and focusing the water primarily on young trees instead of lawns. However, the increase in irrigation in 2012 can likely be explained by the beginning of major construction around the campus and the planting of new trees, grasses and plants.

Figure 1. Water Usage over Time at the University of Arkansas

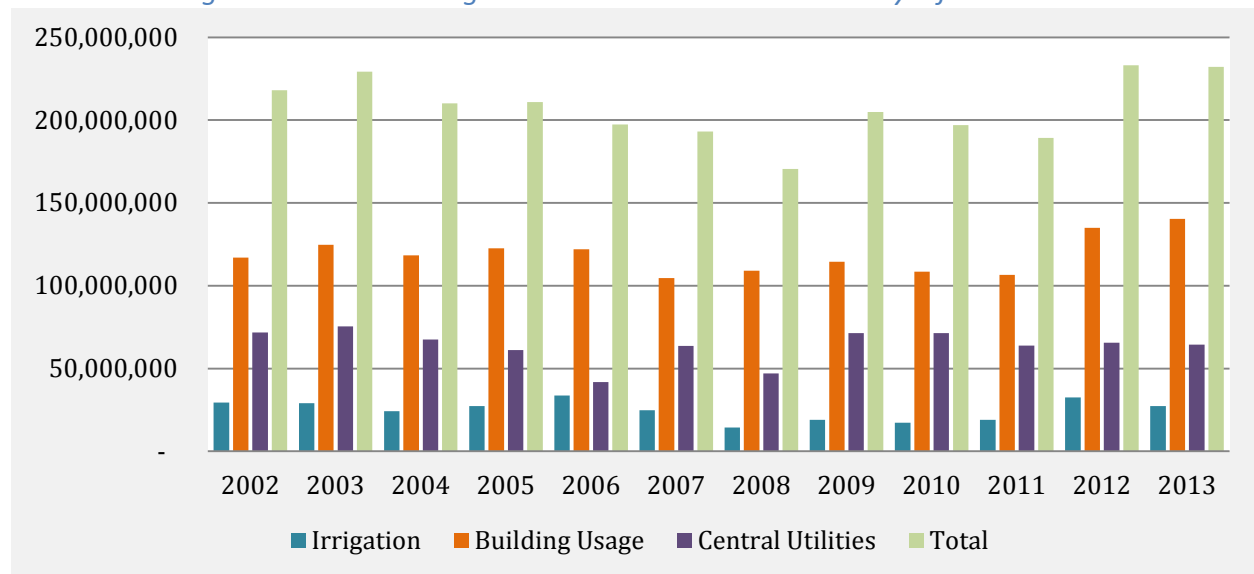
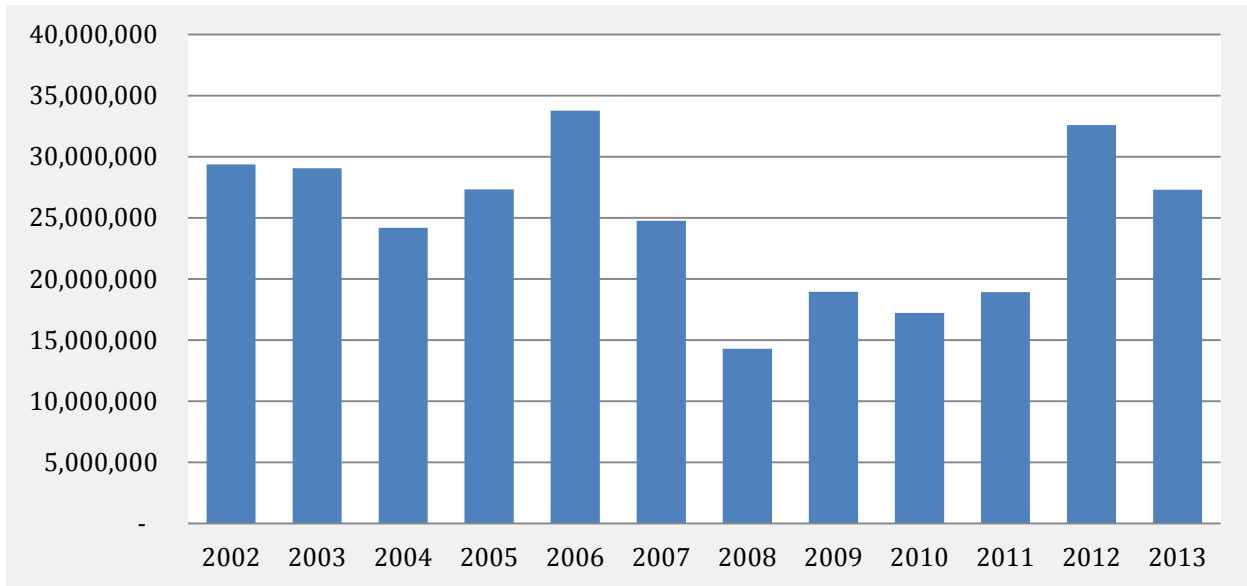


Figure 2. Water Used for Irrigation (in gallons) over Time at the University of Arkansas



Most of the water use on campus is in the buildings (Figure 3). Subcategory analysis suggests opportunities for water savings (Figures 4 and 5). The irrigation of campus fields accounts for three-quarters of the total irrigation and almost a tenth of total water usage, and could be drastically reduced using sensor-based irrigation controls so as to avoid the problem of irrigating in the afternoon or, more obviously, while it is raining. Reducing this value by only 1 percent saves 200,000 gallons of water.

Figure 3. Water Usage at the University of Arkansas by Category, 2013

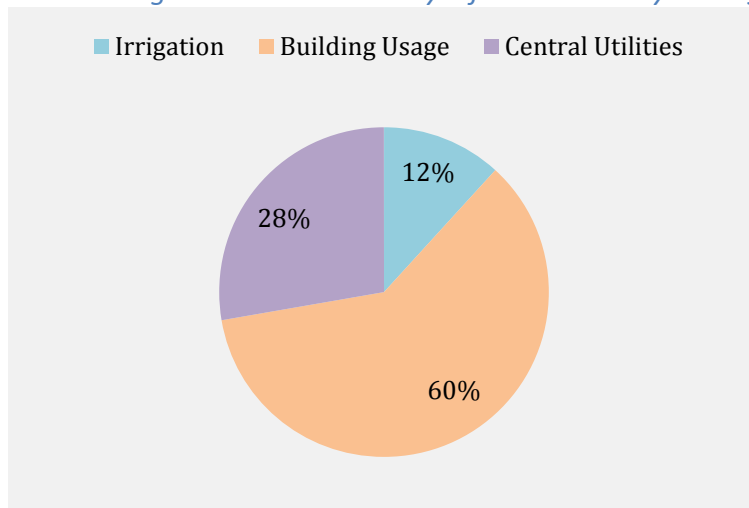


Figure 4. Irrigation and Indoor Water Use at the University of Arkansas by Sub-Categories, 2013

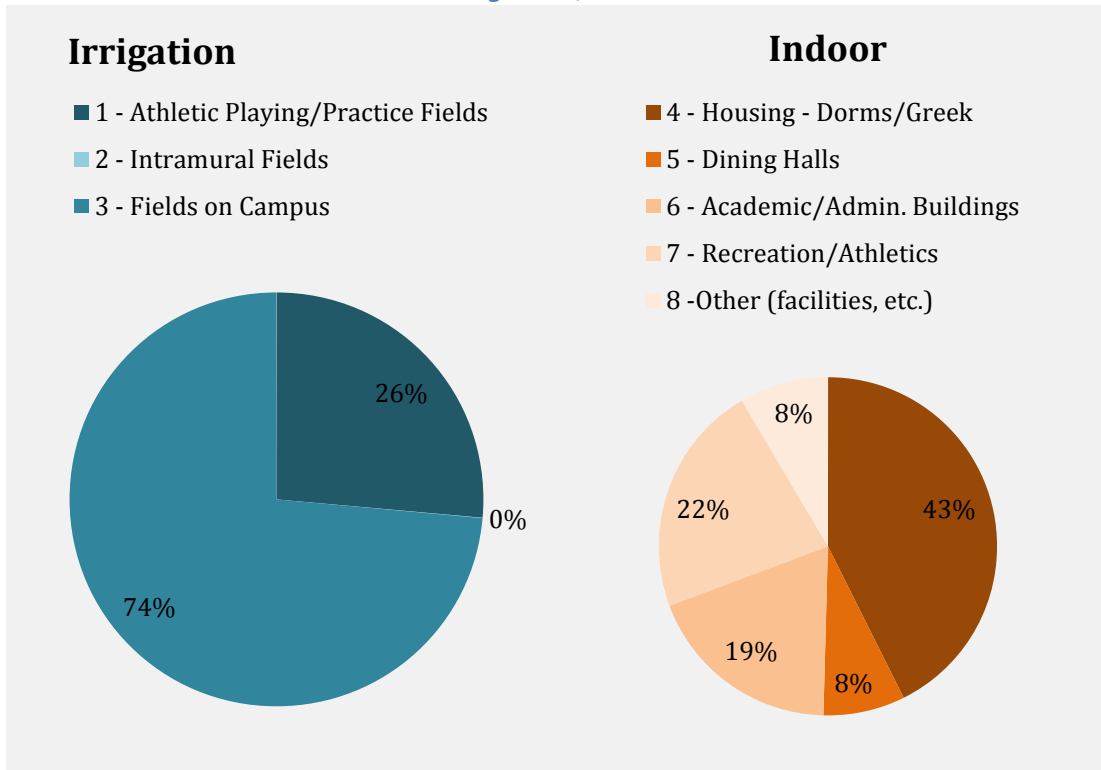
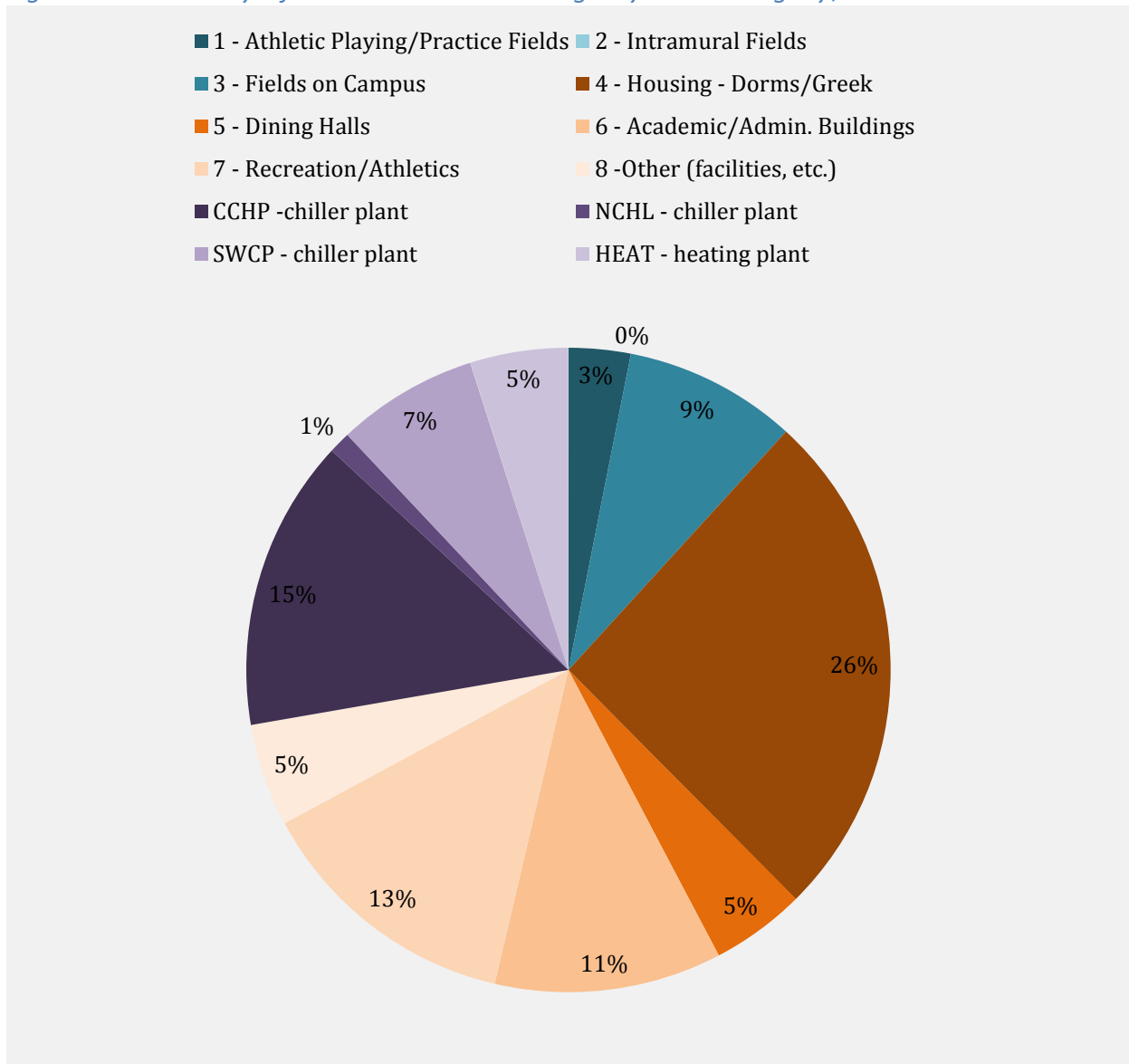


Figure 5. University of Arkansas Water Usage by Sub-Category, 2013



However, the most notable point about this data is that buildings used 60 percent of water in 2013 and almost half of this water was used by housing (Figure 4). This is over a quarter of the total water usage annually (Figure 5). While it makes sense that residence halls would use the most water, it is also clear that this is where the biggest difference can be made.

Conclusion

Total annual water usage at the University of Arkansas has been fairly consistent over the past 10 years, at approximately 230 million gallons per year. In 2013, 60 percent of water usage was from buildings, 40 percent of which being used in the residence halls (about 26 percent overall). Changing irrigation methods appears to have reduced irrigation levels in

the past 7 years, but those reductions have been recently offset due to construction on campus and other possible factors. The University of Arkansas currently pays \$3.00 per thousand gallons of water; reducing water use by 10 percent could save \$69,000 annually. This number, however, does not include the various fees and surcharges associated with water cost. If these costs are taken into account, reducing water use by 10 percent could actually save closer to \$100,000.