

WATER USE ANALYSIS OF COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL CUSTOMERS USING PROPERTY APPRAISER AND BUSINESS DATABASES

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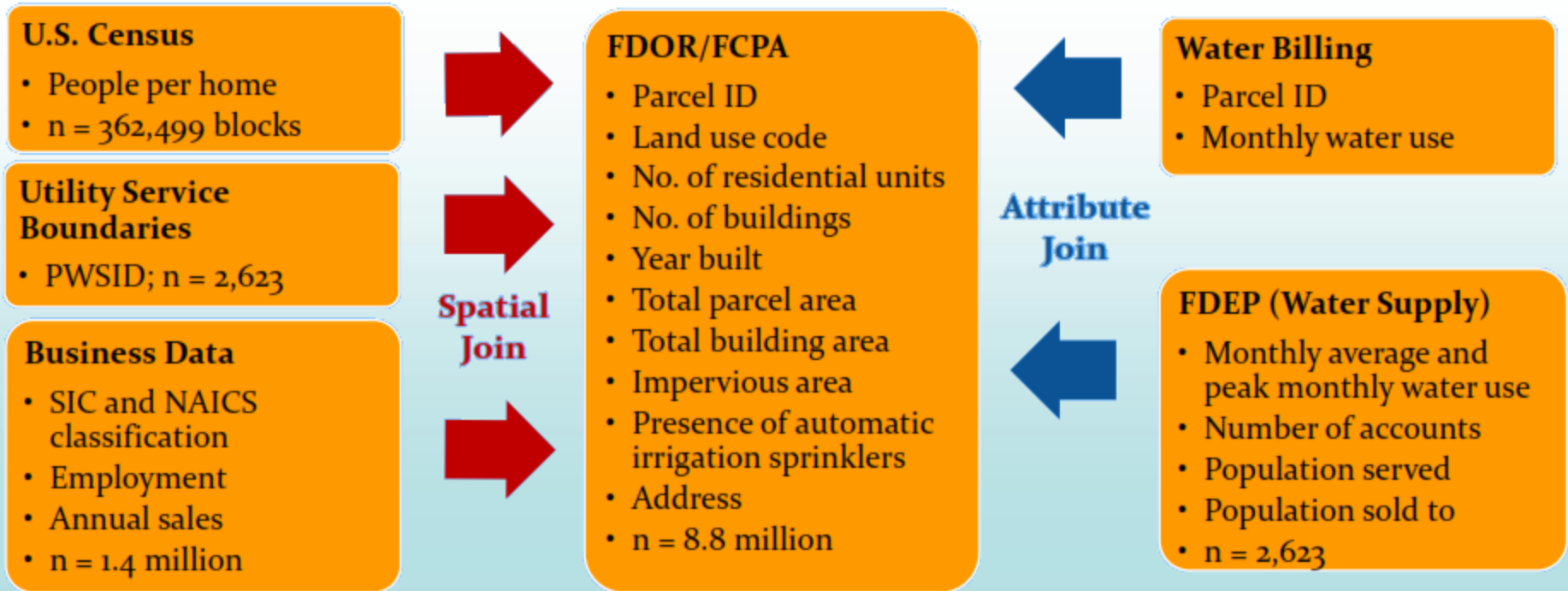
Conserve Florida Water Clearinghouse

- Organization funded through the Florida Dept. of Environmental Protection and Florida's Water Management Districts
- Developed model to serve as state-wide water conservation planning tool (EZ Guide)
 - Estimates water use within a water budget using parcel data
 - Projects water use based on population projections and calibrated parcel use trends from the water budget
 - Evaluates conservation best management practices (BMPs) based on cost-effectiveness using an optimizer
 - Assists in planning BMP implementation and tracking



<http://ezguide.conservefloridawater.org>

Parcel-Level Data-Driven Approach



Database Joins in Austin, TX

	Water Billing	Property ID Link	TCAD Join	InfoGroup Join
Premise Count	17,187	14,921	12,086	8,208
% Matched	100%	87%	70%	48%
Water Use (MGD)	53.40	45.64	31.13	26.24
% Matched	100%	85%	58%	49%
Avg. Premise Water Use (kgal/mo)*	256 (730)	269 (744)	311 (778)	439 (930)
Parcel Count	N/A	N/A	8,418	5,230
Avg. Parcel Building Area (sf)*	N/A	N/A	37,413 (51,963)	57,427 (56,992)

*Standard deviations shown in parenthesis

- Significant reduction in sample size following all database joins
- TCAD does not include tax exempt parcels in their database
- Business databases only provide a sample of all businesses
- Final joined database accounted for 48% of premises and 49% of CII water use

CII Classification Schemes

- Final joined database included three distinct classification schemes:
 - Austin Water, Premise Type (N = 43)
 - Travis Central Appraisal District, Improvement Code (N = 82)
 - North American Industry Classification System, 2 to 6-digit codes
 - 2-digit (N = 24)
 - 3-digit (N = 99)
 - 4-digit (N = 313)
 - 5-digit (N = 724)
 - 6-digit (N = 1,175)



Classification Scheme Comparison

- The relationship between water use and building area was used to compare the classification of CII parcels by the three schemes
- A functional relationship is viewed as a better means of comparing schemes as opposed to simple measures of homogeneity
- Linear and power functions were fit, power function R^2 statistics are shown

Sectors with Sample \geq 30 Parcels	Austin's Premise Type	TCAD Improvement Code	Two-digit NAICS
Number of Sectors	16 of 43	27 of 82	19 of 24
Average R^2*	0.37 (0.30)	0.23 (0.20)	0.45 (0.20)
R^2 Range	0.04 - 0.97	0.00 - 0.66	0.12 - 0.82

*Standard deviations shown in parenthesis

- NAICS is shown to compare favorably to the other classification schemes
 - Highest average R^2 and lowest R^2 standard deviation across sectors with at least 30 parcels

2-digit to 3-digit NAICS Comparison Based on Functional Relationship between Building Area and Water use (Top 15 3-digit NAICS in Austin, TX)

3-digit NAICS	3-digit NAICS Description	Parcel Count	Water Use vs. TCAD Building Area				Total Water Use (MGD)	% of Total Water Use
			R ²	Power Fit R ² of 2-digit Counterpart	% Change			
334	Computer & Electronic Product Mfg.	40	0.96	0.75	26.9%	4.5	17.1%	
561	Administrative & Support Serv.	275	0.4	0.38	7.3%	3.87	14.7%	
541	Professional, Scientific, & Tech. Serv.	503	0.7	0.69	2.0%	2.84	10.8%	
722	Food Services and Drinking Places	394	0.22	0.43	-49.2%	2.11	8.0%	
238	Specialty Trade Contractors	159	0.6	0.43	39.2%	1.52	5.8%	
621	Ambulatory Health Care Services	204	0.45	0.31	46.2%	1.11	4.2%	
721	Accommodation	68	0.75	0.43	76.1%	0.96	3.7%	
423	Merchant Wholesalers, Durable Goods	193	0.72	0.59	21.4%	0.66	2.5%	
445	Food and Beverage Stores	183	0.15	0.43	-65.9%	0.64	2.5%	
811	Repair and Maintenance	280	0.21	0.19	11.7%	0.61	2.3%	
812	Personal and Laundry Services	171	0.28	0.19	52.0%	0.57	2.2%	
813	Religious, Civic, Prof., & Similar Org.	170	0.4	0.19	113.7%	0.55	2.1%	
452	General Merchandise Stores	24	0.27	0.17	52.5%	0.46	1.8%	
522	Credit Intermediation & Related Act.	108	0.54	0.55	-2.4%	0.44	1.7%	
531	Real Estate	164	0.11	0.12	-10.5%	0.44	1.7%	
	Other NAICS	1,593	0.44	0.34	26.8%	4.97	18.9%	
	Total	4,622	0.34	0.34	0.0%	26.24	100.0%	

- On the average, going from 2- to 3-digit NAICS improved the R² relationship by 21%

Modeling Water Use for Estimation Normalization Percentiles for Benchmarking

3-digit NAICS	Description	N	TCAD Avg. Building Area (sf)*	Avg. Water Use (gpd)*	Avg. Weighted Water Use Coef. (gal/sf/d)	Avg. Water Use Coef. (gal/sf/d) Percentiles			Linear and Power Fits:
						25th	50th	75th	Water Use (gpd) vs. TCAD Building Area (sf)
722	Food Services and Drinking Places	394	7,470 (9,613)	2,687 (3,535)	0.36	0.193	0.36	0.657	L: $m = 0.236$; $R^2 = 0.08$
									P: $a = 28.9$; $b = 0.524$; $R^2 = 0.22$
721	Accommodation	68	60,445 (64,344)	12,811 (14,665)	0.212	0.145	0.193	0.259	L: $m = 0.204$; $R^2 = 0.74$
									P: $a = 0.726$; $b = 0.894$; $R^2 = 0.75$
All NAICS		4,622	23,065 (45,973)	2,245 (5,478)	0.0973	0.0281	0.0755	0.193	L: $m = 0.0747$; $R^2 = 0.32$
									P: $a = 0.824$; $b = 0.8$; $R^2 = 0.34$

*Standard deviations shown in parenthesis

Number of Employees and Annual Sales as Drivers of Water Use

3-digit NAICS	N	TCAD Avg. Building Area (sf)*	Avg. Number of Employees*	Avg. Annual Sales (\$1,000)*	Avg. Water Use (gpd)*	Avg. Weighted Water Use Coef. (gal/emp/d)	Avg. Water Use Coef. (gal/emp/d) Percentiles			Linear and Power Fits:
							25th	50th	75th	Water Use (gpd) vs. No. Emp.
722	101	4,475 (3,564)	25.9 (19.9)	\$1,297 (\$1,689)	1,957 (1,715)	75.4	46.7	74.4	112	L: $m = 72.1$; $R^2 = 0.58$ P: $a = 86.2$; $b = 0.954$; $R^2 = 0.58$
721	16	61,103 (41,370)	27.3 (26.9)	\$1,839 (\$2,553)	13,230 (13,531)	484	325	473	636	L: $m = 406$; $R^2 = 0.35$ P: $a = 1530$; $b = 0.681$; $R^2 = 0.44$
All NAICS	821	13,120 (21,296)	23.3 (40.4)	\$3,305 (\$7,989)	1,601 (3,504)	68.6	18.5	47.8	113	L: $m = 43.2$; $R^2 = 0.12$ P: $a = 316$; $b = 0.595$; $R^2 = 0.2$

*Standard deviations shown in parenthesis

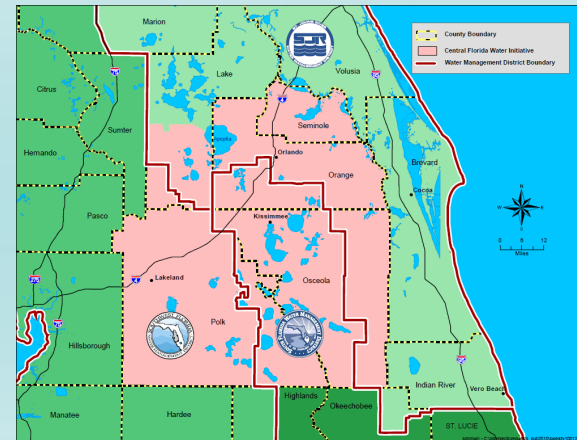
- NAICS 722 (Food and Drinking Places) shows a much stronger relationship between water use and number of employees as opposed to building area
- NAICS 721 (Accommodation) shows the opposite

Additional Applications of this Database-Driven Approach

- Improved Water Use Modeling
 - Utility & Regional Planning Analysis
- Hydro-econometric Modeling
 - Economic Impact of Water
 - Resource Allocation
- Life Cycle Analysis
- Improved Measures of Efficiency



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Conclusions

- Data-driven parcel-level approach developed at the University of Florida has substantially moved the water conservation field forward by facilitating quantitative evaluations of options
- Nationwide implementable approach
 - Property appraiser (usually free) and Business databases (~\$2,400 for county) available throughout the United States
- Business data provides:
 - NAICS, a nationwide standardized classification system
 - Number of employees and annual sales, additional and significant drivers of water use

Acknowledgements



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Environmental Engineers & Scientists



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