

Commercial and Institutional Water Use

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Texas Water Development Board—Economic and Demographic Analysis

Introduction

Background

- What is commercial and institutional (C/I) water use?
- Create benchmarks for C/I water use
- PWS reports aggregate C/I use on the Water Use Survey
 - 4,870 PWS systems surveyed in 2018 and 942 did not report C/I use
 - 1,732 PWS reported the C/I use as 0
 - 21% : C/I 945,368 acft – total municipal net use 4,534,174 acft
- Want to find information that is subsector specific (Socioeconomic impact of water intensive sectors)

Literature Review

- Very few studies available on C/I water use
- Common normalizing factors were heated building area and number of employees
- Studies found focused primarily on hospitals, hotels, and restaurants
- Primarily useful in determining what data would be useful for estimations

Methodology

Overview

1. Collect site-specific sample data for each sub-sectors
2. Estimate water use per unit (employee, student, bed, etc): The gallons per unit per day (annual gallons used divided by unit divided by 365)
3. Run a regression analysis
4. Test estimated use with utility billing data
5. Estimate missing water use data

Data Sources

- **2019 WSC Utility Profile Data (Top 5 Users)**
- Manta (online NAICS code lookup)
- TCEQ CR Query—Customer Search
- NAICS Association
- Texas Workforce Commission
- US Census Bureau CBP Data
- TEA Enrollment Data
- American Hospital Directory
- Texas Department of Criminal Justice
- County Appraisal Districts

Categorization

- Categorize the customer data presented on the WSC Utility Profile data based on 2-digit NAICS code
- Locate the county each PWS serves and find appropriate address of the business
- Utilize the NAICS association, Manta, and TCEQ CR Query—Customer Search
- Not all accounts could be sorted into a subsector

Target Sectors

- Summarize data to see number of accounts within in each subsector
- Considerations
 - Total use in acre-feet
 - Total number of accounts in each sector
 - Potential units of estimation
 - Readily availableness of data

Sector	Number of Firms	Proportion of Firms	Acre-feet of Use	Proportion of Use
Laundry	21	1.88%	267	0.12%
Car Wash	37	3.32%	627	0.27%
Golf Course	16	1.43%	1,401	0.61%
Grocery	34	3.05%	4,157	1.81%
Accommodations	64	5.73%	7,213	3.13%
Hospital	79	7.08%	8,285	3.60%
Prison	54	4.84%	10,138	4.40%
School	291	26.08%	29,500	12.83%
Other	520	46.59%	168,630	73.24%
Grand Total	1,116	100%	230,246	100%

Units of Estimation

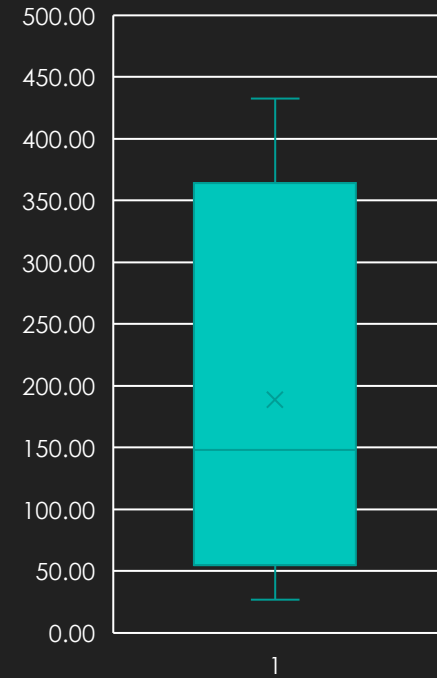
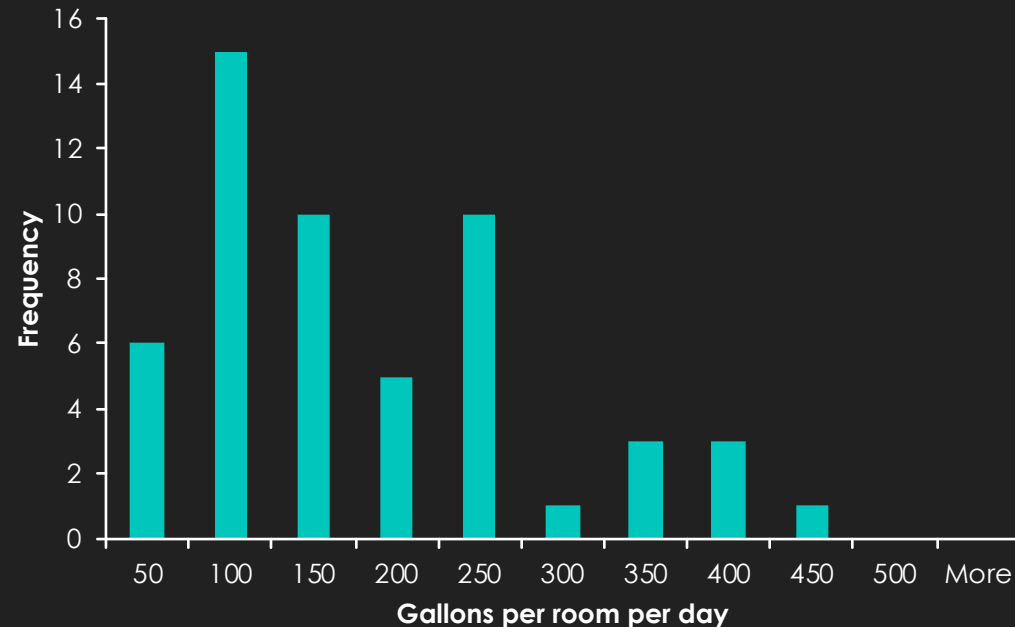
- Accommodations: total number of rooms
- Car Washes: total square feet
- Golf courses: total yards of a course
- Groceries: total square feet
- Hospitals: total staffed beds and total square feet
- Laundry: total square feet
- Prisons: inmate capacity
- Schools: total number of students

Regression Analysis

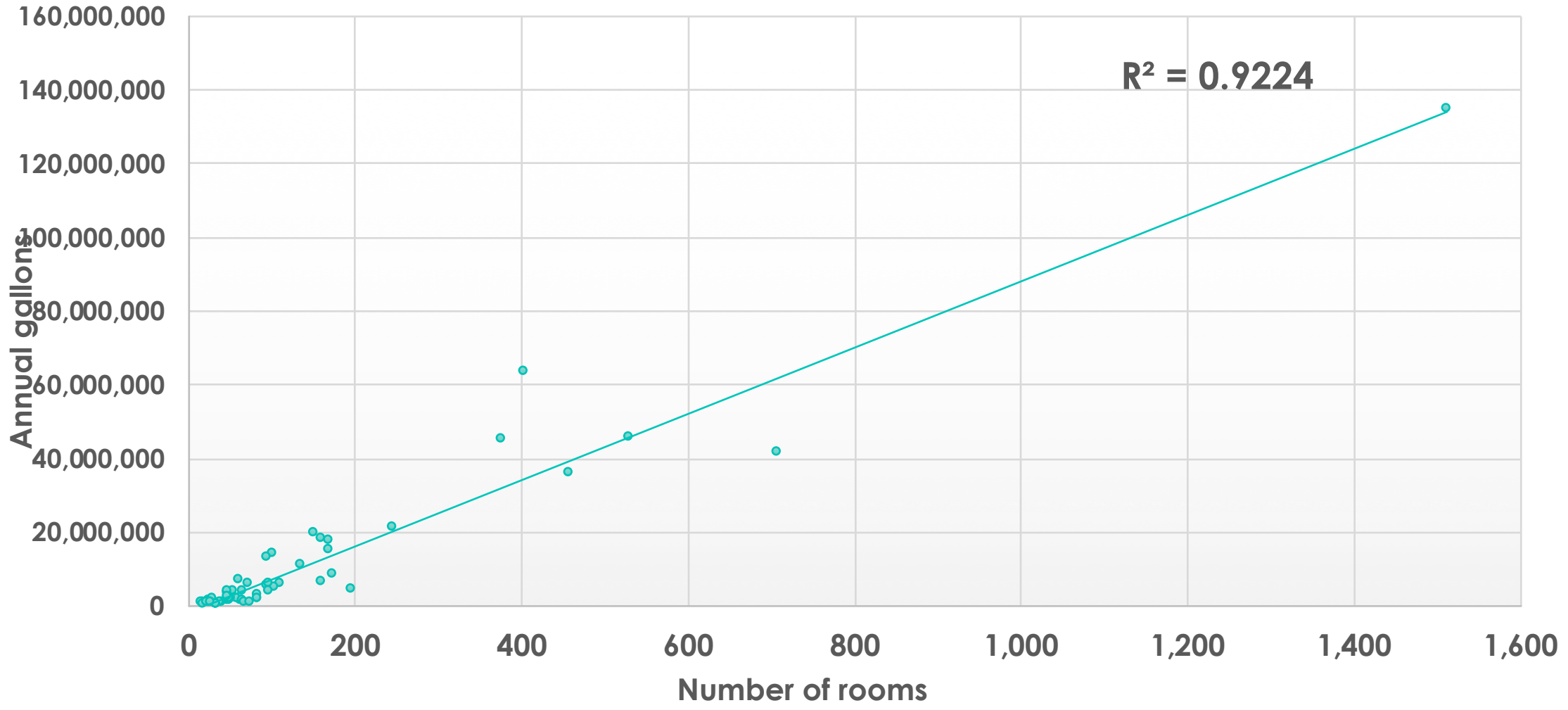
Accommodations

Total Number of Rooms

Total Number of Accounts	54
Max gallons per room per day	432.71
Min gallons per room per day	26.82
Average gallons per room per day	158.41



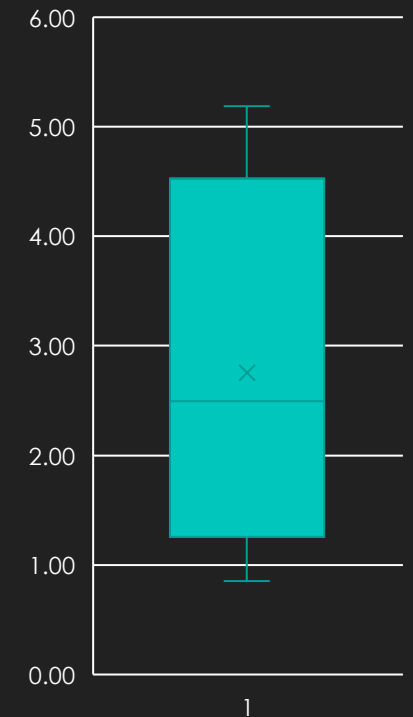
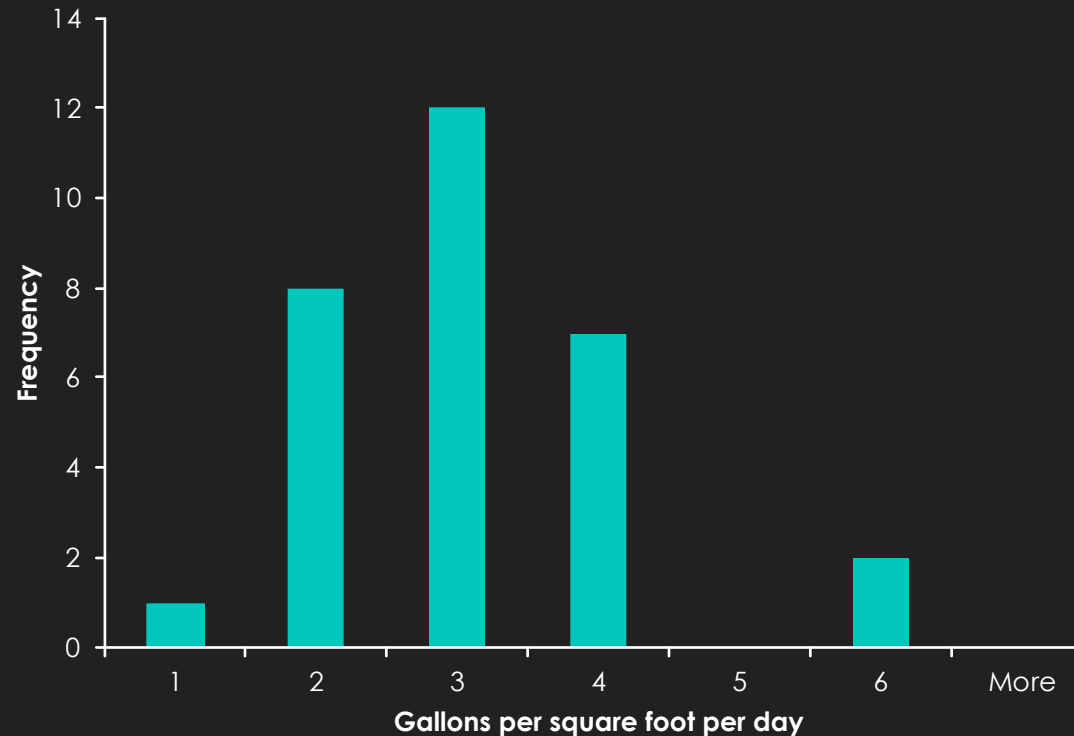
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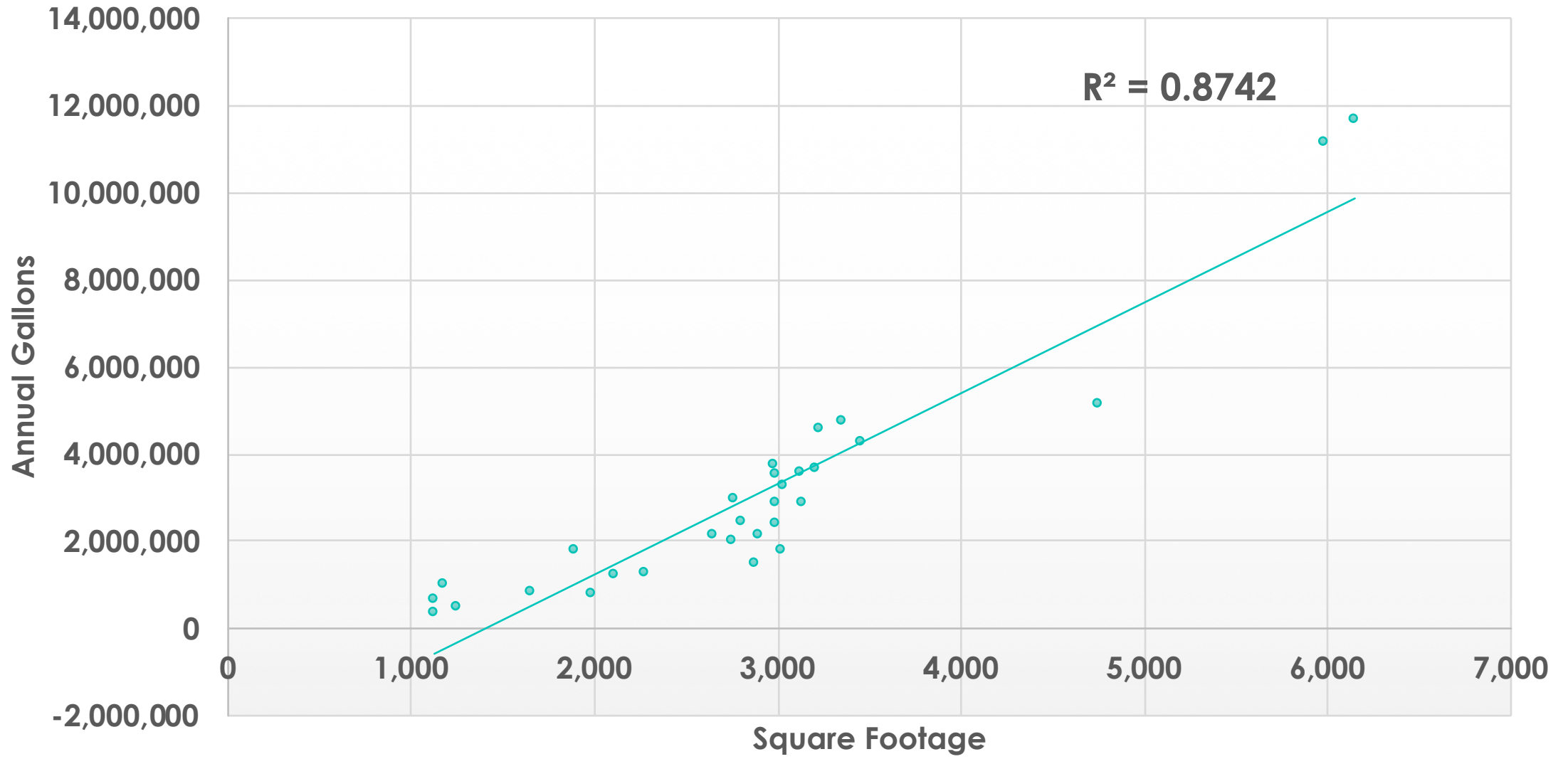


Car Washes

Total Square Feet

Total Number of Accounts	30
Max gallons per sq. ft. per day	5.19
Min gallons per sq. ft. per day	0.85
Average gallons per sq. ft. per day	2.53

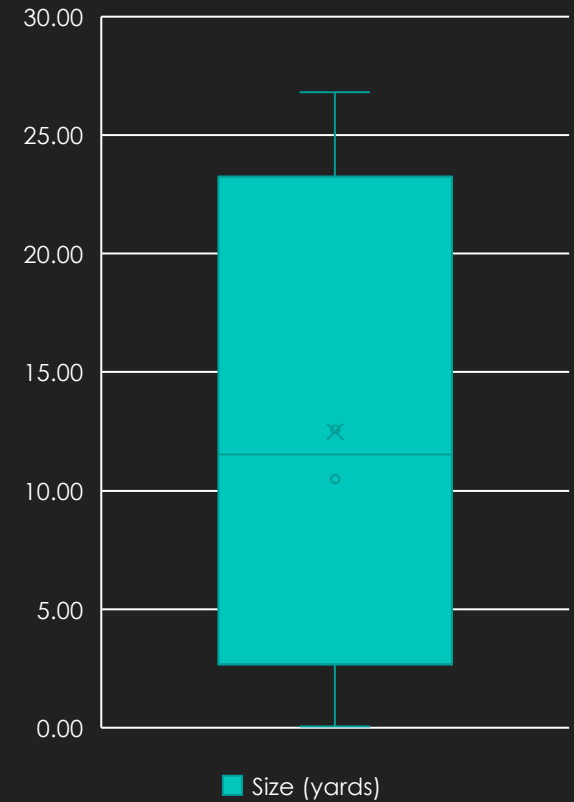
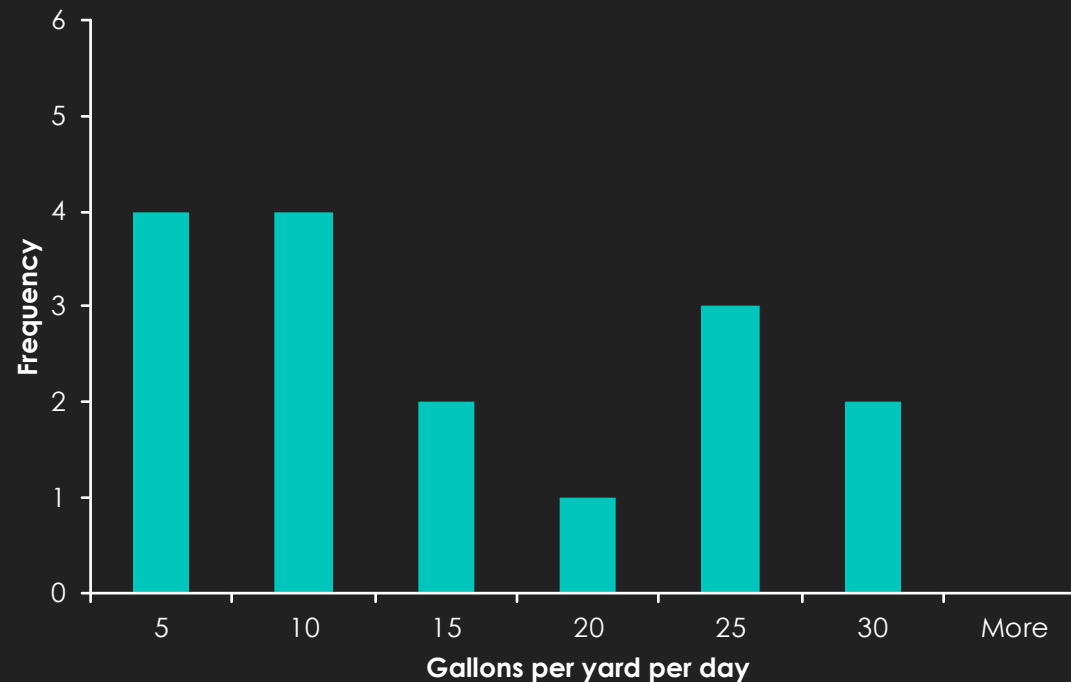


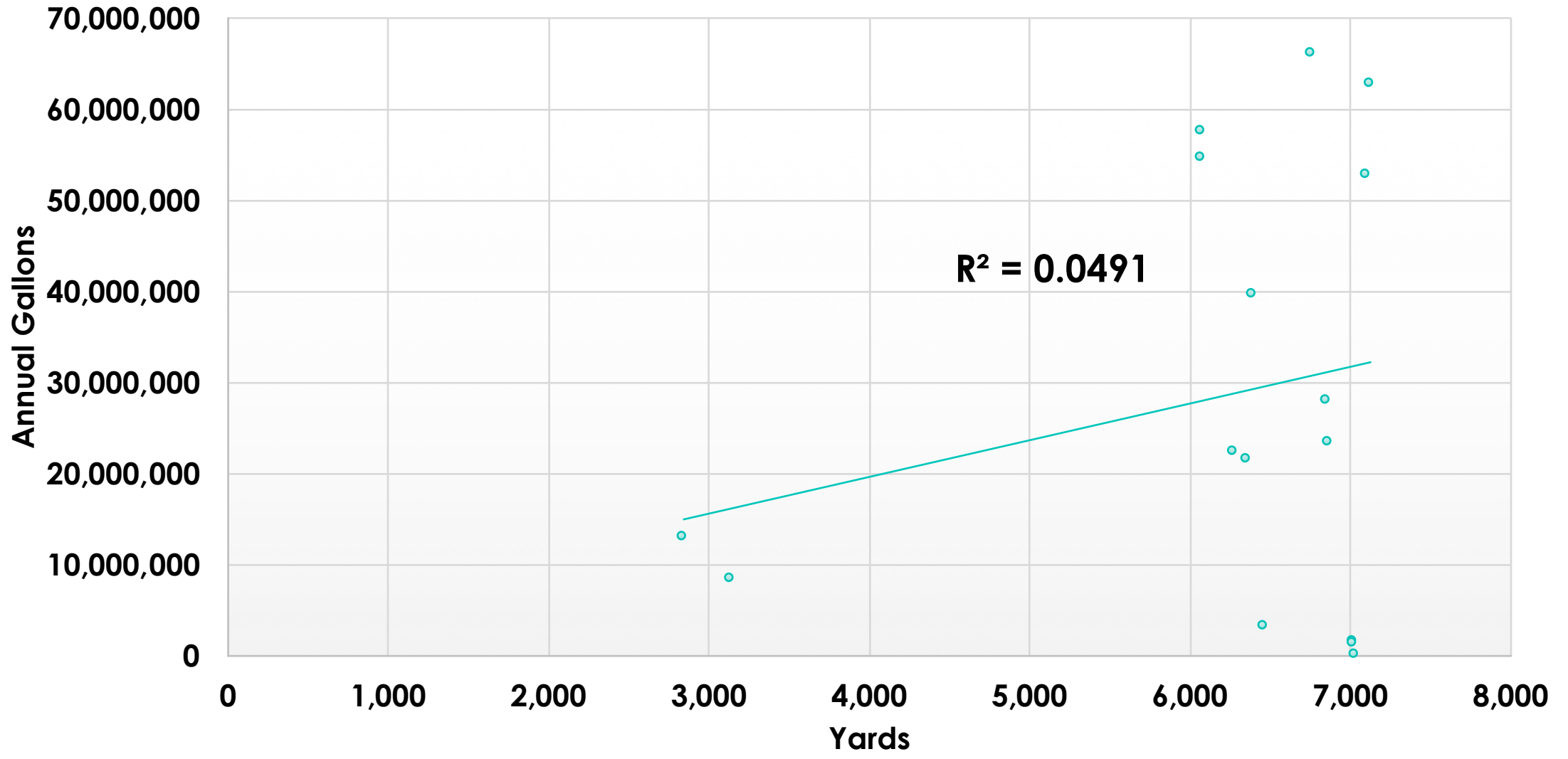


Golf Courses

Total Yardage

Total Number of Accounts	16
Max gallons per yard per day	26.81
Min gallons per yard per day	0.05
Average gallons per yard per day	12.57

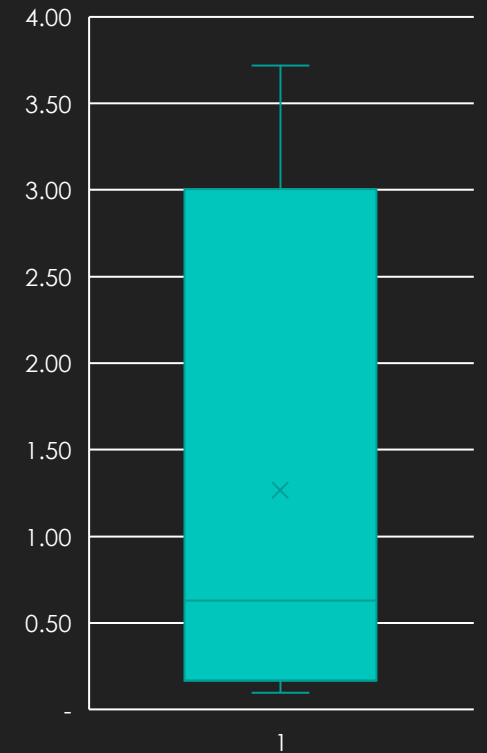
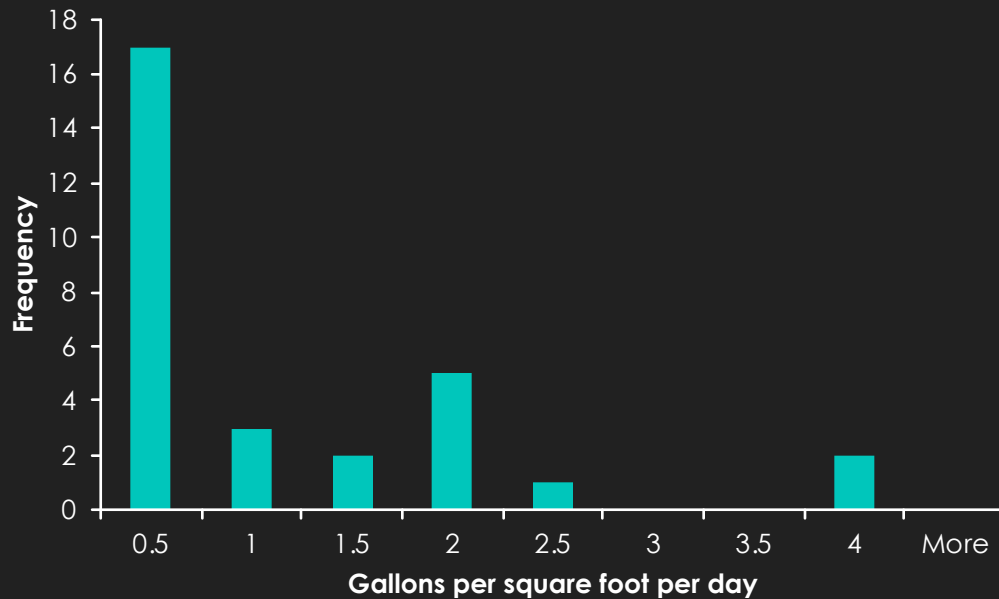


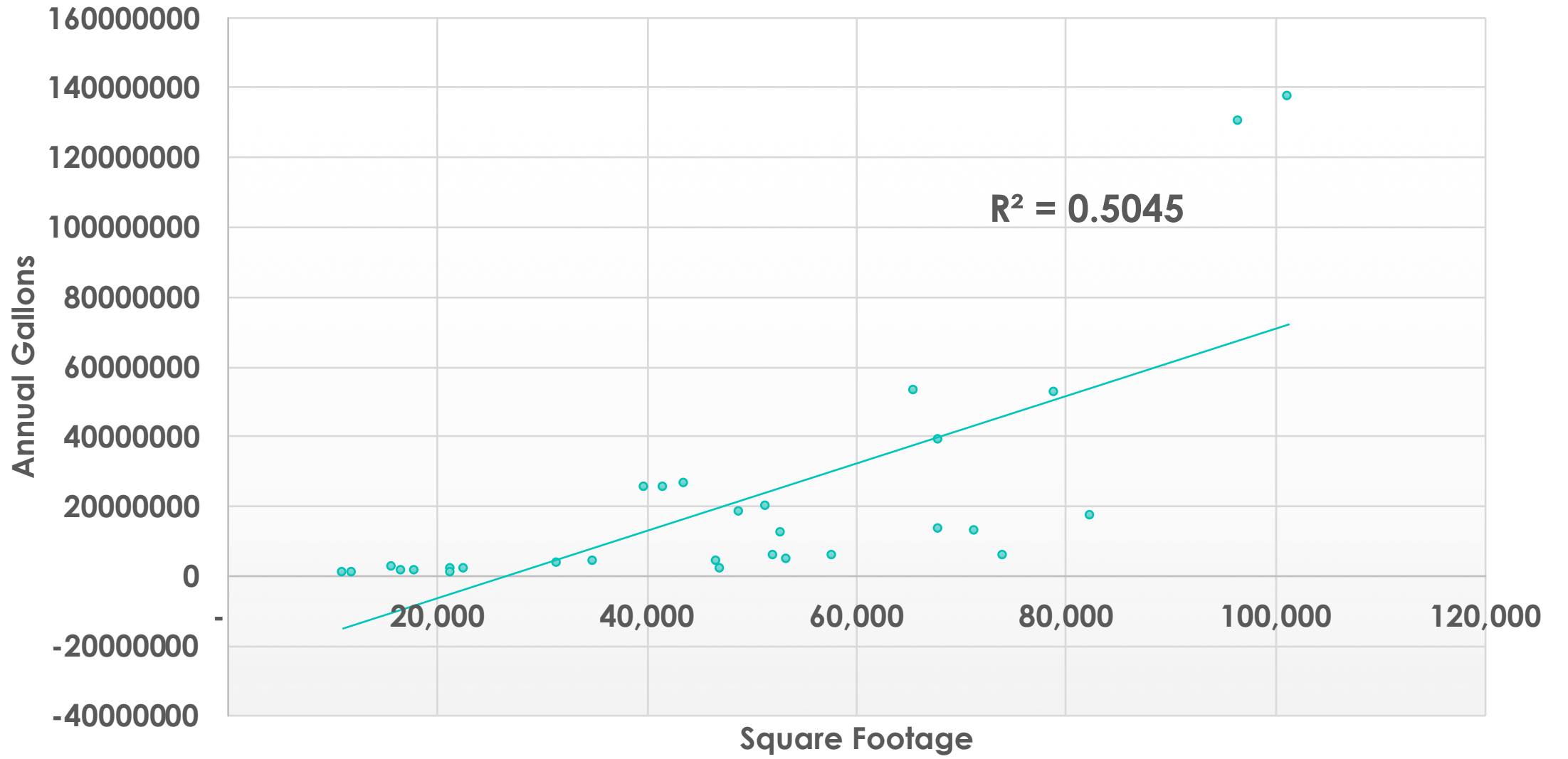


Groceries

Total Square Feet

Total Number of Accounts	30
Max gallons per sq. ft. per day	3.72
Min gallons per sq. ft. per day	0.10
Average gallons per sq. ft. per day	0.87

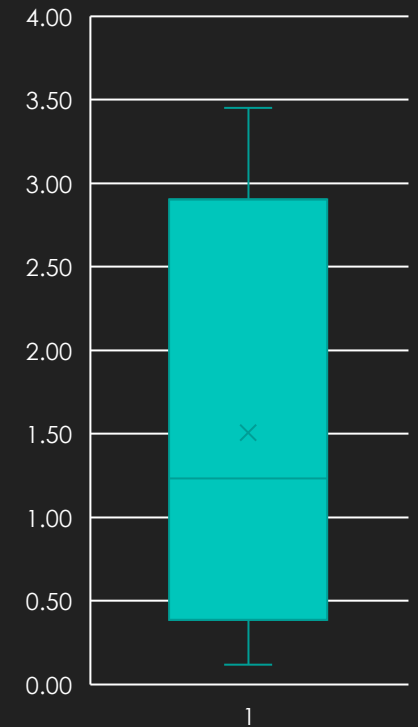
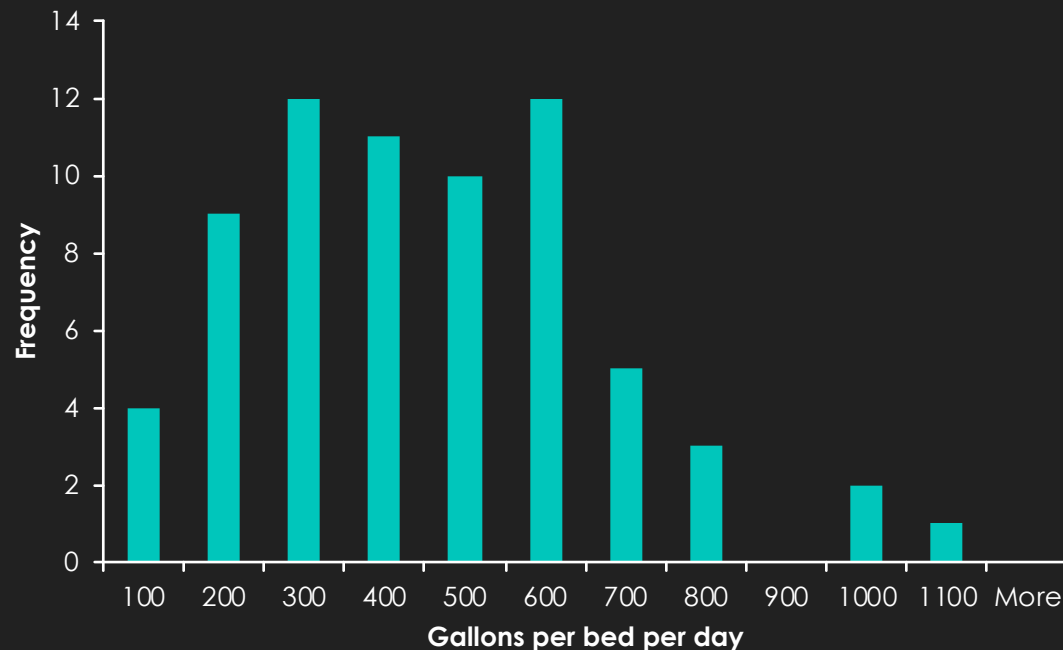


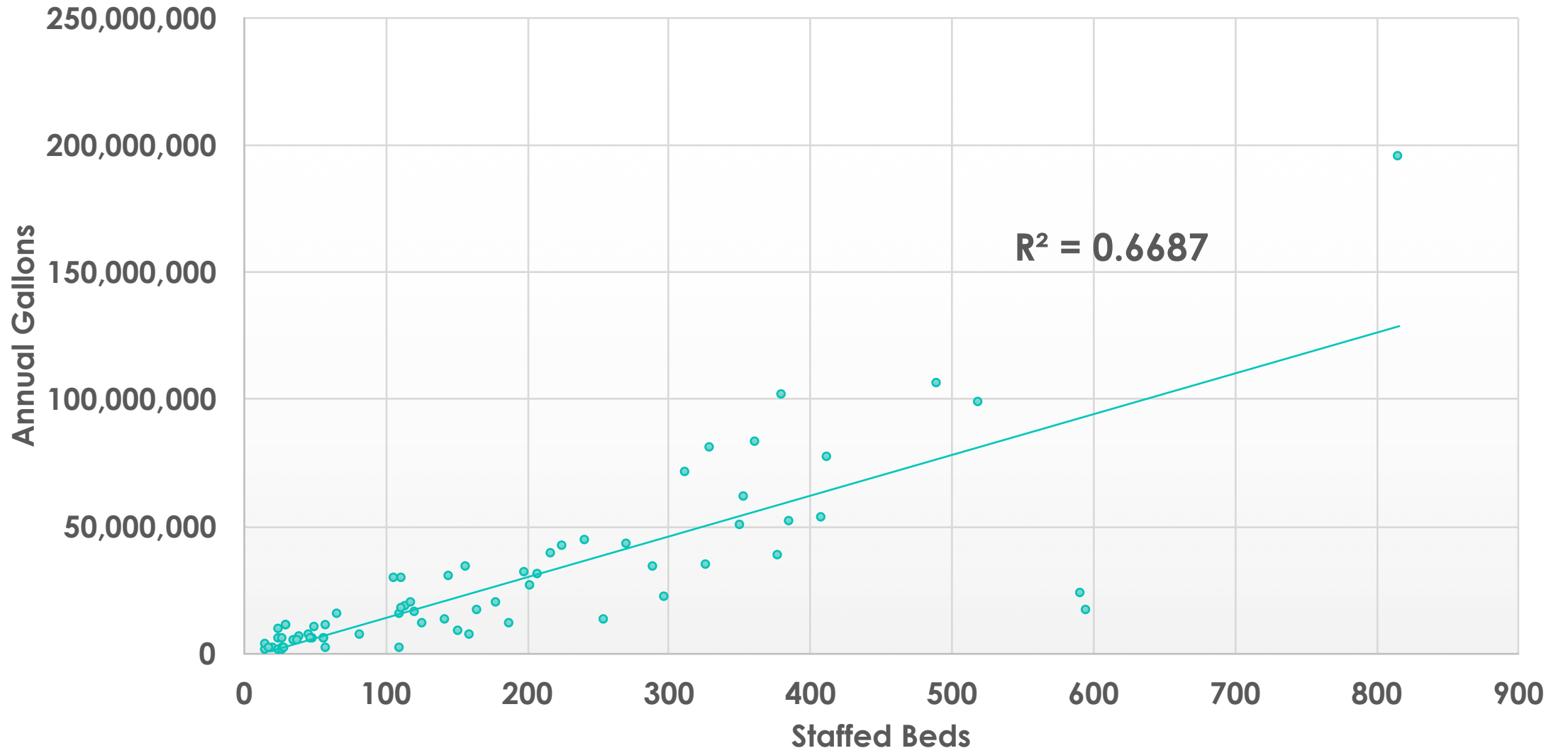


Hospitals—Total Staffed Beds

Total Number of Beds

Total Number of Accounts	69
Max gallons per bed per day	1288.04
Min gallons per bed per day	45.65
Average gallons per bed per day	422.85

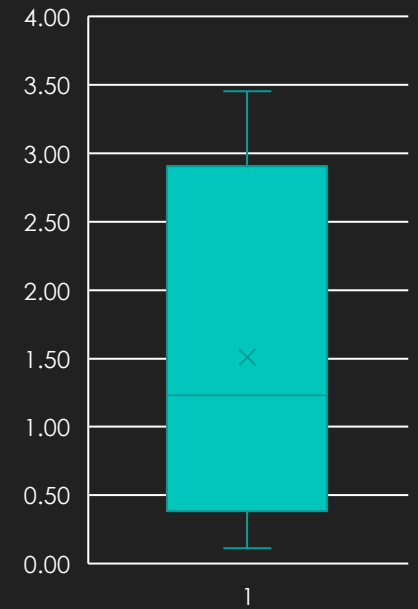
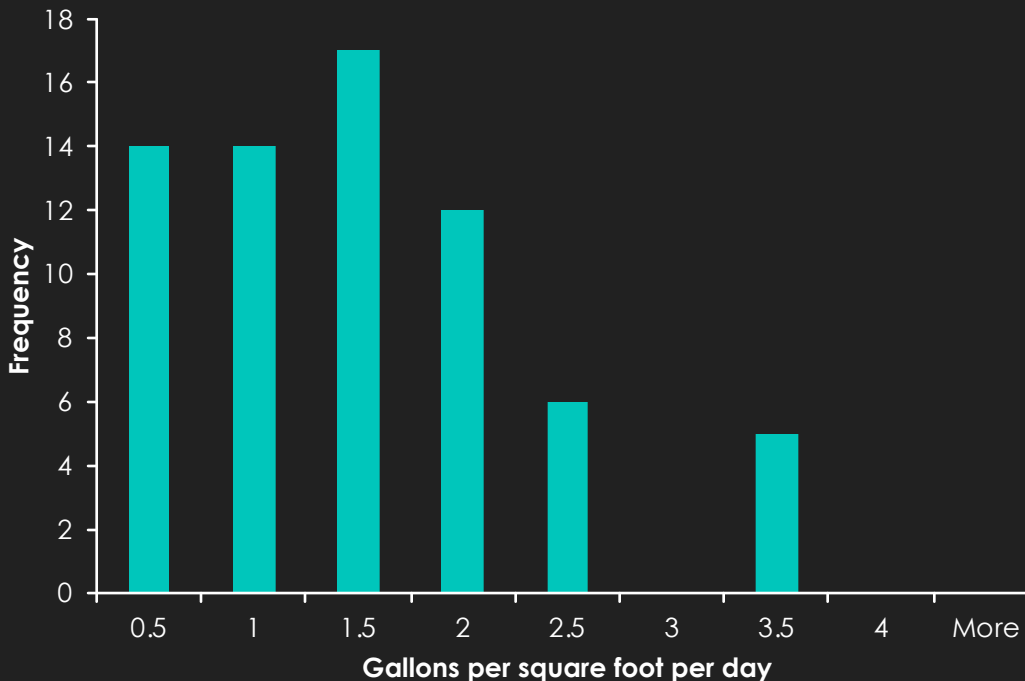


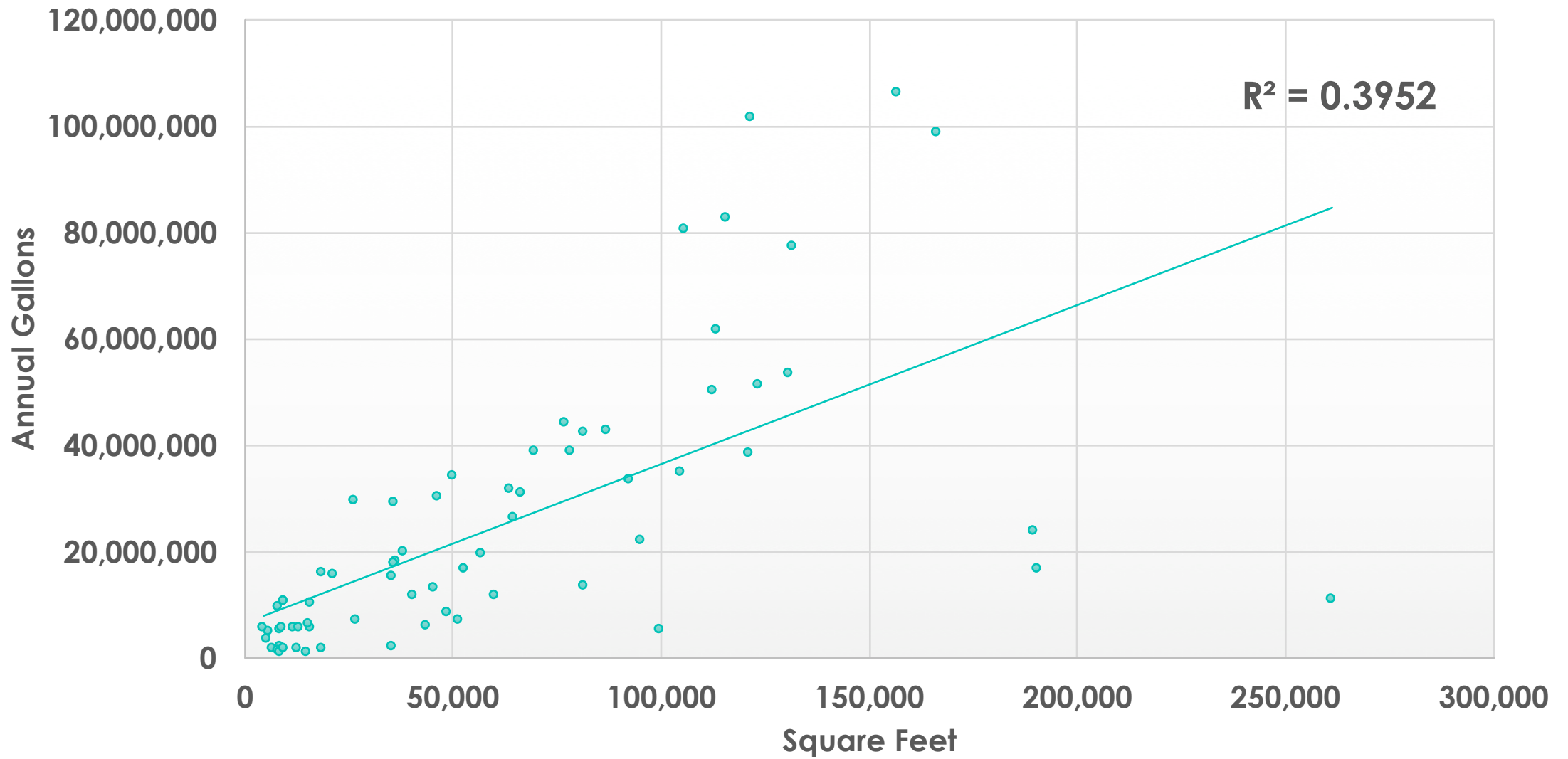


Hospitals—Total Square Feet

Total Square Feet

Total Number of Accounts	68
Max gallons per sq. ft. per day	3.45
Min gallons per sq. ft. per day	0.12
Average gallons per sq. ft. per day	1.26

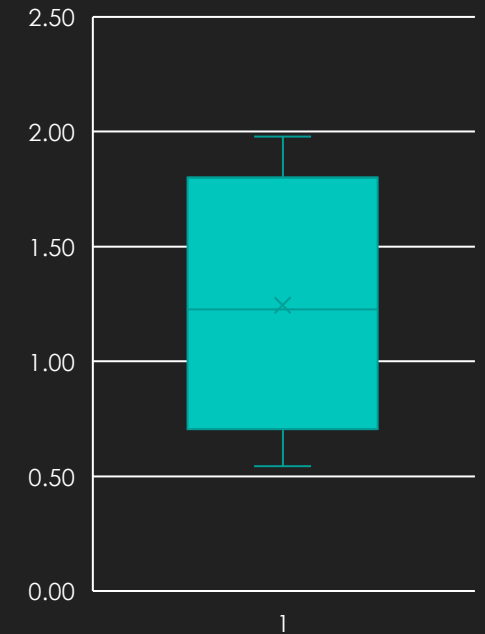
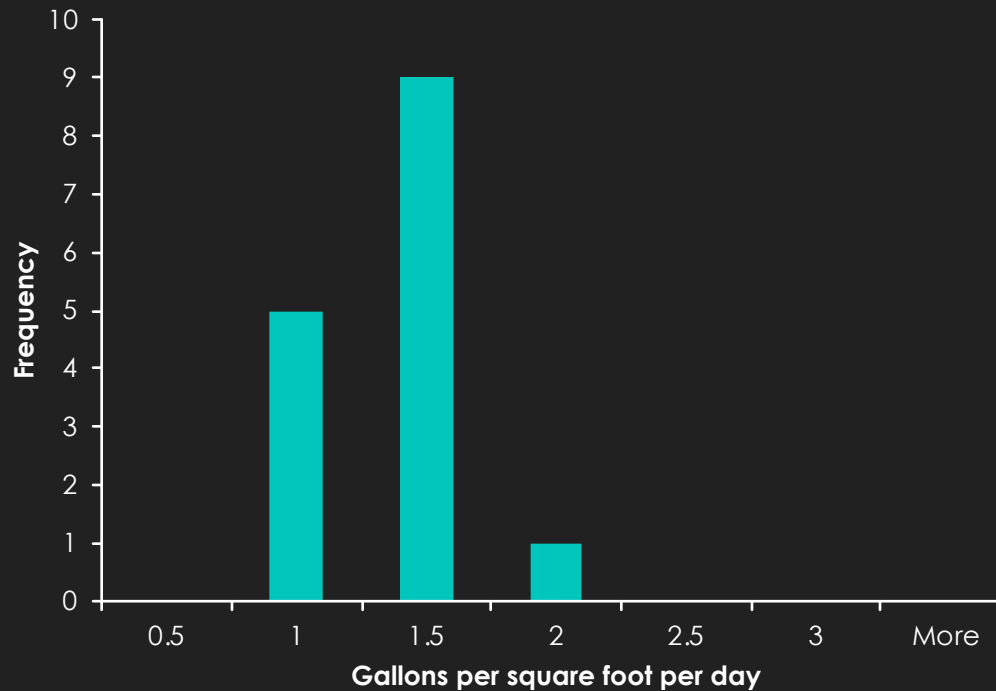


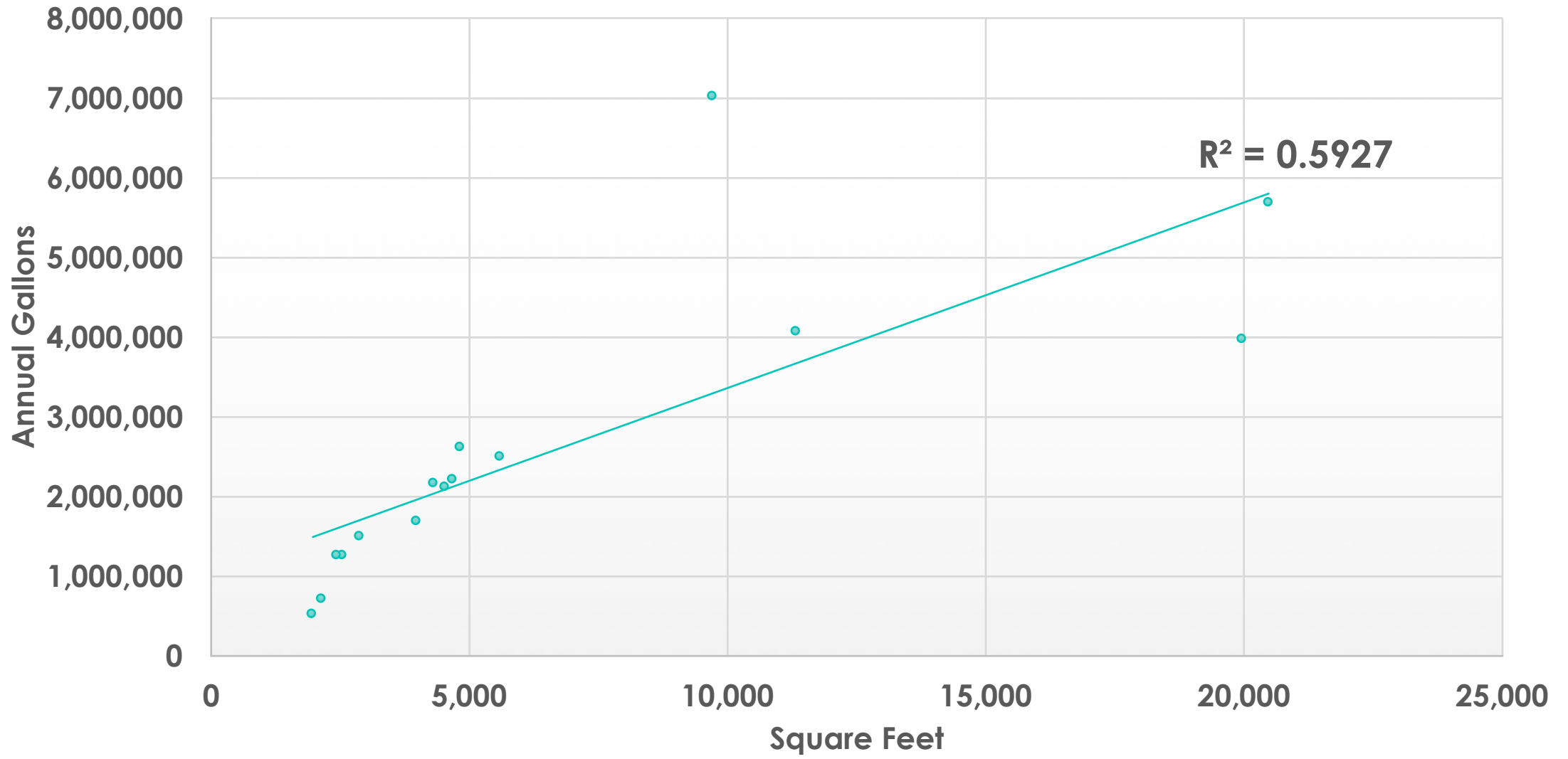


Laundry

Total Square Feet

Total Number of Accounts	15
Max gallons per sq. ft. per day	1.98
Min gallons per sq. ft. per day	0.54
Average gallons per sq. ft. per day	1.19

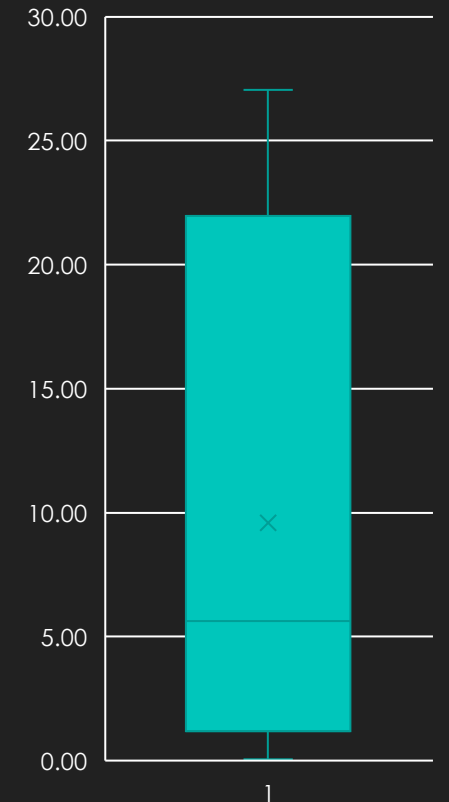
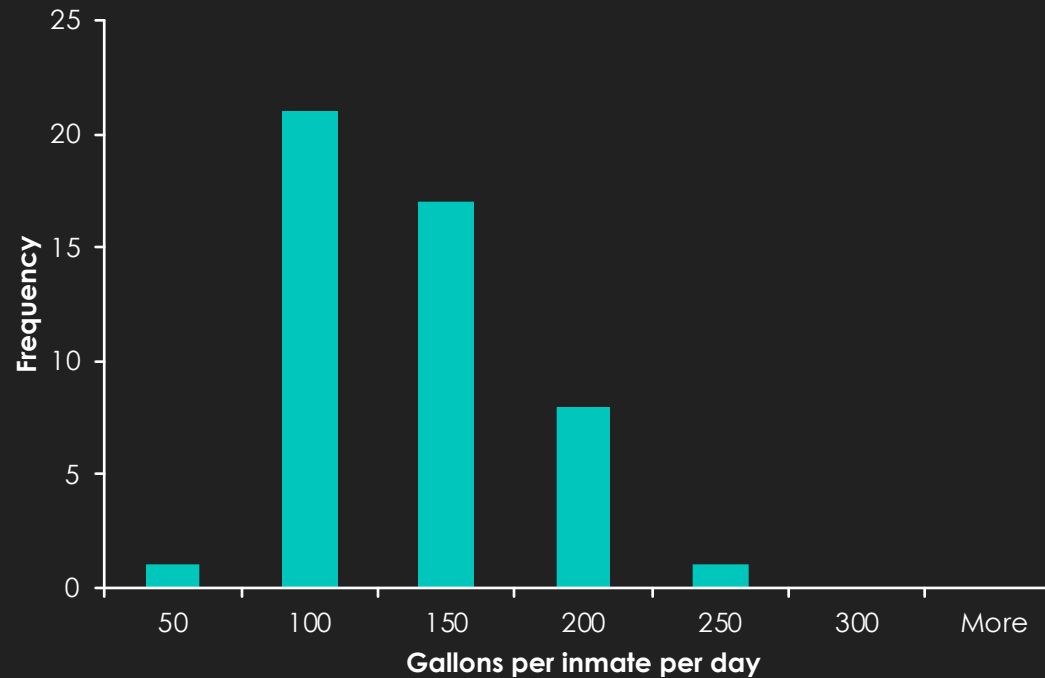


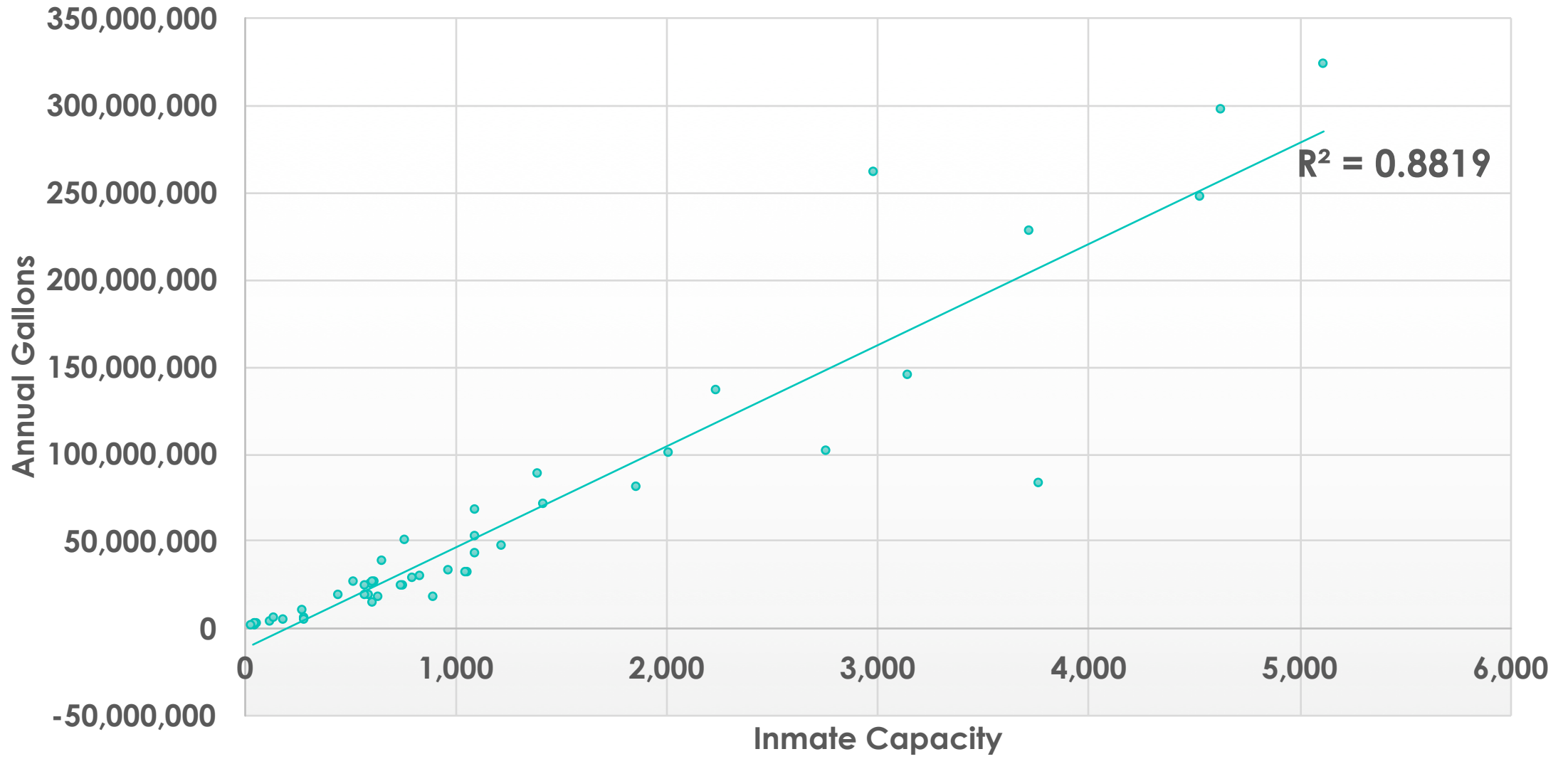


Prisons—Capacity

Total Number of Inmates

Total Number of Accounts	48
Max gallons per inmate per day	239.88
Min gallons per inmate per day	46.02
Average gallons per inmate per day	111.69

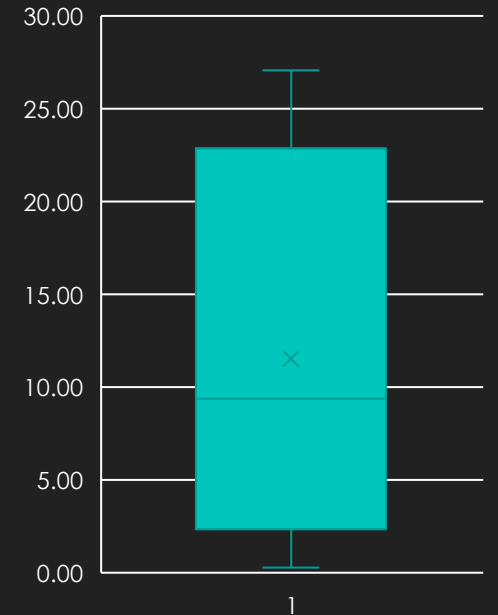
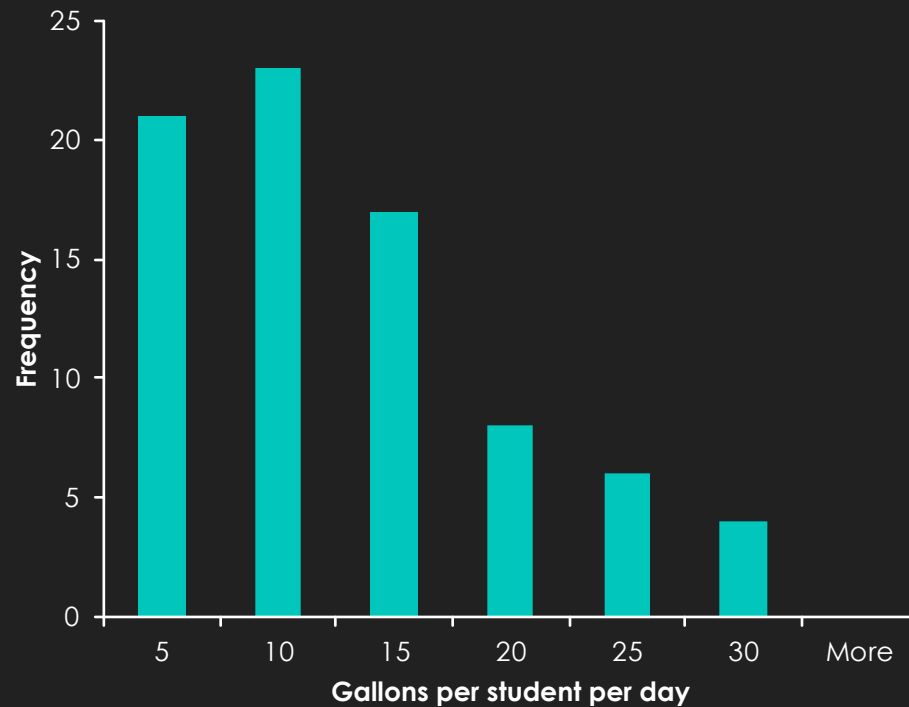


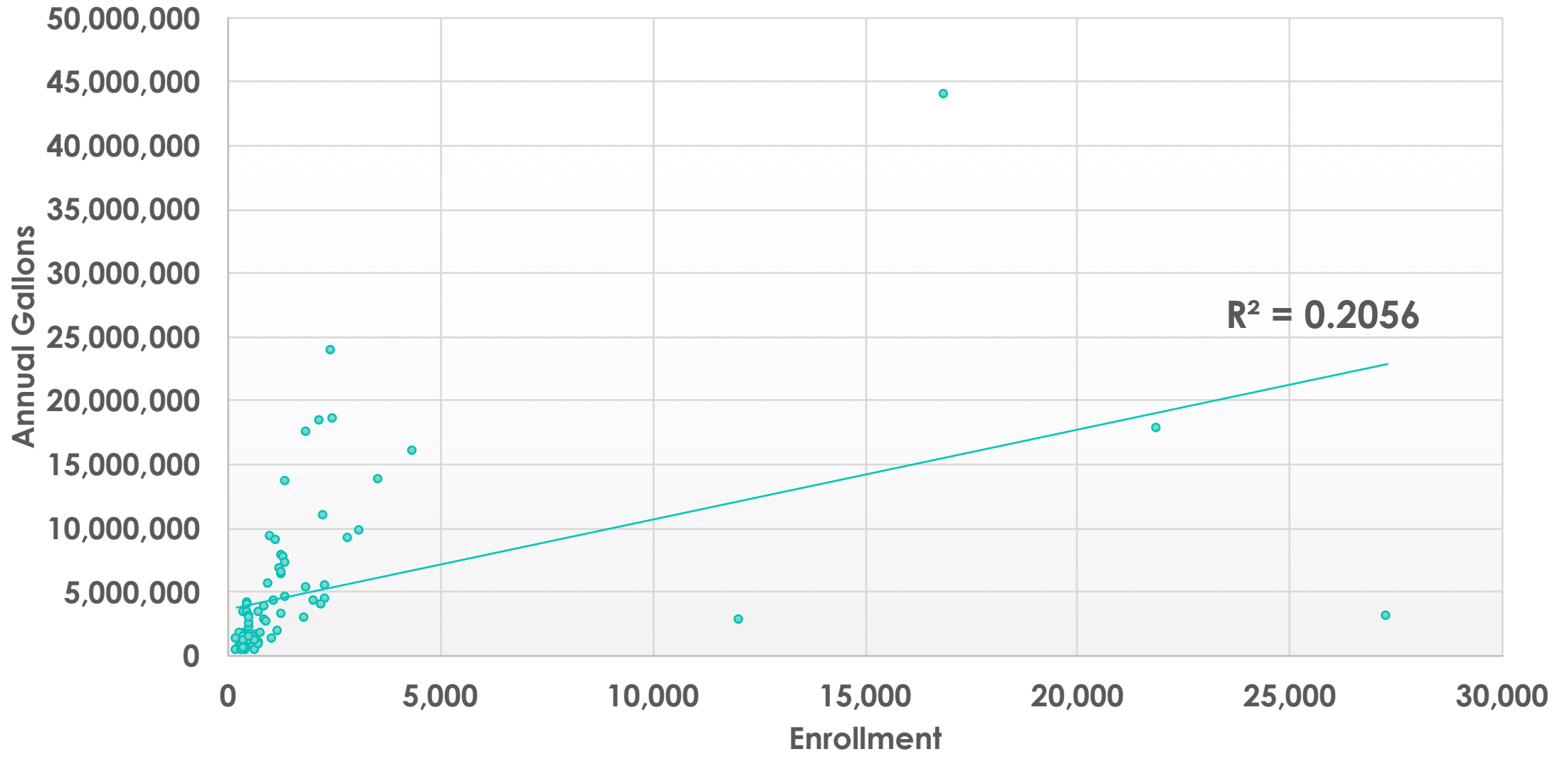


Individual Schools

Total Number of Students

Total Number of Accounts	79
Max gallons per student per day	27.05
Min gallons per student per day	0.30
Average gallons per student per day	10.25

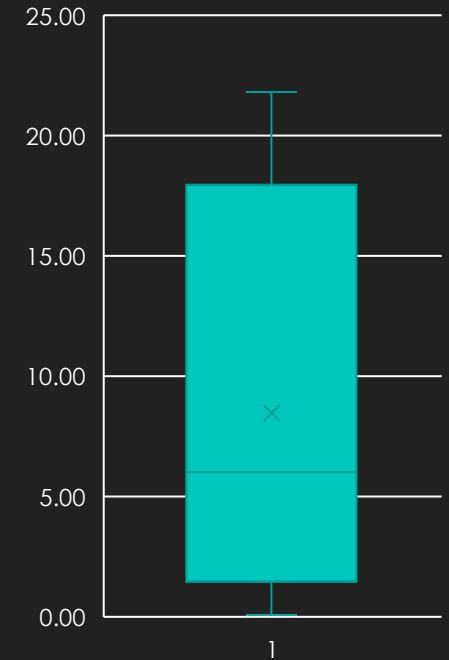
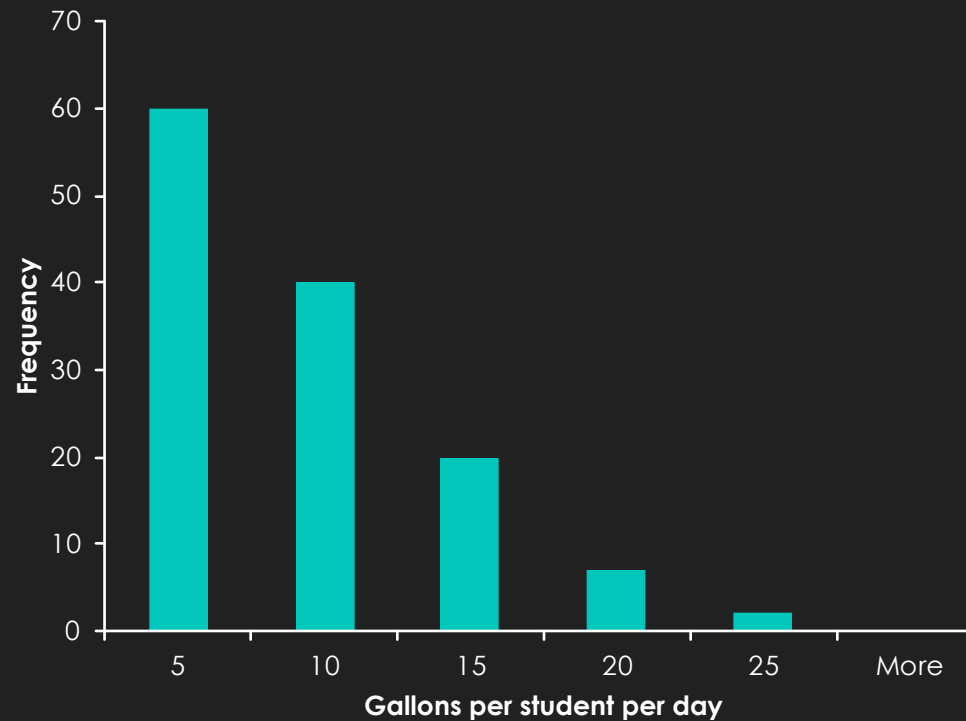


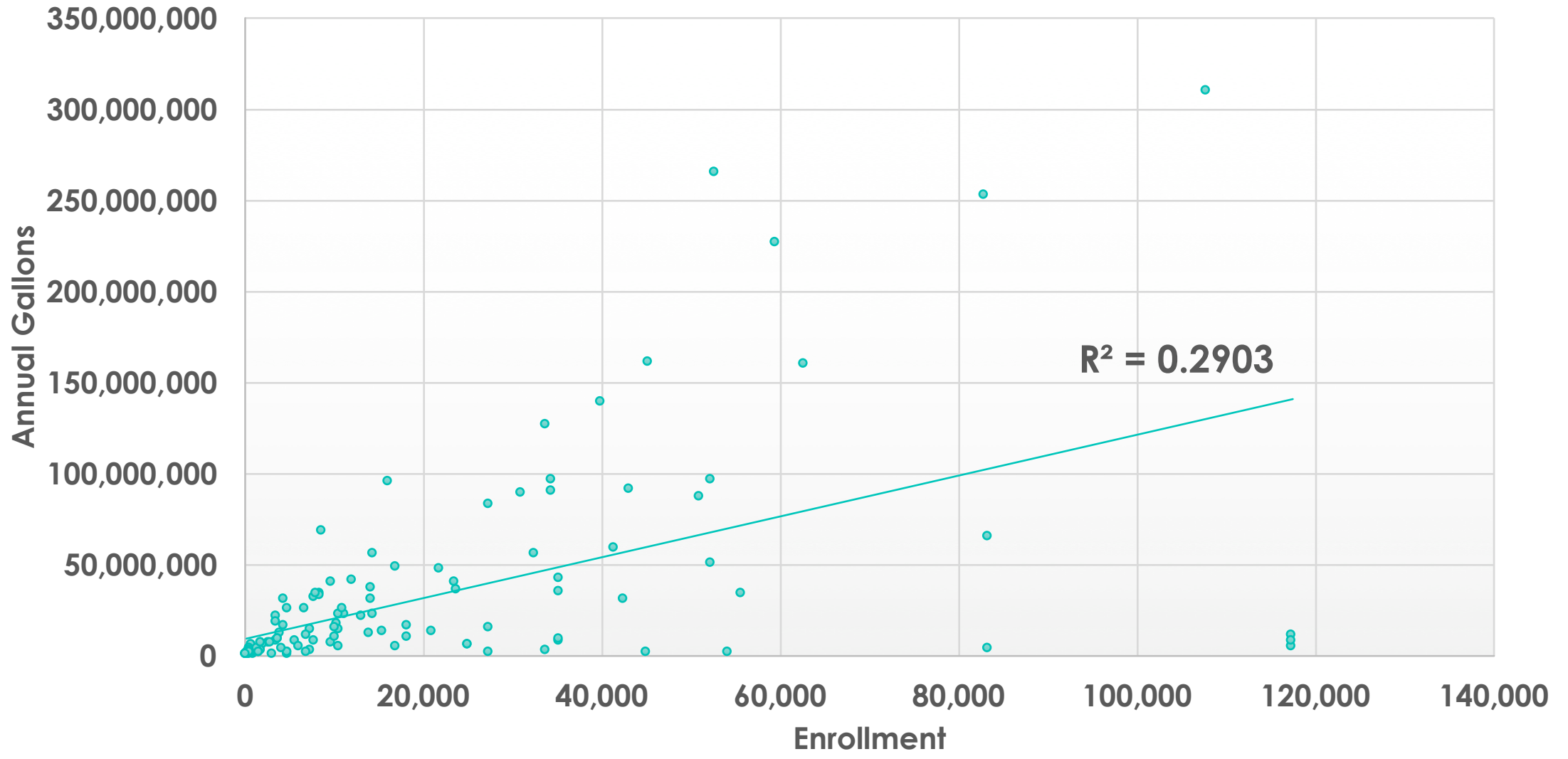


School Districts

Total Number of Students

Total Number of Accounts	129
Max gallons per student per day	21.80
Min gallons per student per day	0.07
Average gallons per student per day	6.35





Comparison to other work

Accommodations

Our Study	Brendle Group Study in Colorado	Journal of Water Resources
Max GPD: 432.71	Max GPD: 578.96	Max GPD: 679.23
Min GPD: 26.82	Min GPD: 24.01	Min GPD: 18.03
Average GPD: 158.41	Average GPD: 134.83	Average GPD: 201.67
R ² : 92.2%	R ² : 96.7%	R ² : 86.2%

Individual Schools

Our Study	Brendle Group Study in Colorado
Max GPD: 27.05	Max GPD: 31.48
Min GPD: 0.30	Min GPD: 1.27
Average GPD: 10.25	Average GPD: 12.23
R ² : 20.6%	R ² : 22.3%

Comparisons Continued

Hospitals—Square Footage

Our Study	University of Florida Study
Max GPD: 3.45	Max GPD: 19.62
Min GPD: 0.12	Min GPD: 1.08
Average GPD: 1.26	Average GPD: 10.13
R ² : 39.5%	R ² : 7.12%

Hospitals—Total Staffed Beds

Our Study	Journal of Water Resources
Max GPD: 1288.04	Max GPD: 1179.65
Min GPD: 45.65	Min GPD: 41.12
Average GPD: 422.85	Average GPD: 439.12
R ² : 66.9%	R ² : 68.9%

Conclusions and Future Work

- Baseline of developing benchmarks for predictions and planning
- Consider subsectors with high water usage but low number of accounts
- Create benchmarks that can be used to create estimates at various city sizes
- Collect commercial/institutional water use data from utilities

Questions?