Case Study 2: Site and Building Water Use

Valerie Mitchell, Amanda Housh, Allison Gray

Building Description

- J.A. Albertson Building (est. 2002)
- Location: 875 Campus Dr.
- Building Use: College Of Business & Economics, Accounting, Business, Ctr For Bus Dev & Entrepreneurship, Registrar's Office, ITS-Administrative Technologies
- Building Type: Educational without cafeteria, gym, or showers
- Total Square Feet: 61,200 sq. ft.
- Features: 8 bathrooms(1 required per 50 occupants), 10 drinking fountains (1 required per 100 occupants), 2 janitor sinks
- Occupancy Max: 1,224 people
- Peak Hours: M-F, 8am-3pm, 400 max

Water Conservation

Water Fixture Inventory

Fixture Type	Men	Women	Either	Recyclable?
Toilet	6	12	1	N/Blackwater
Urinal	6	-	-	N/Blackwater
Drinking Fountain	-	-	10	Y/Greywater
Lavatory	6	6	1	Y/Greywater
Service Sink	-	-	2	Y/Greywater

Toilets: 1.6 gallons per flush
Urinals: 0.6 gallons per flush

Per Capita Use: 15 gallons/day (MEEB TABLE 19.2)
Peak Hourly Occupancy Load:: 400 people
Total Gallons/Day: (WU) (15x400) = **6,000 gal/day**

Conventional Water Supply

GPFU = (WU) / (fu)

WU = total conventional water use (gallons/day)

fu = total number of conventional fixture units

(6000) / 159.5 =

37.6 gallons/fixture

(MEEB TABLE 19.15)

Fixture	Occupancy	Type of Supply	Number	Cold	Hot	WSFU	Total FU
Lavatory	Public	Faucet	13	1.5	1.5	2	26
Urinal	Public	¾ in flush valve	6	5	0	5	30
Toilets	Public	Flush Tank	19	5	0	5	95
Service Sink	Offices etc.	Faucet	2	2.25	2.25	3	6
Water Fountain	Offices etc.	⅜ in. valve	10	0.25	0	0.25	2.5
Total			**50**				**159.5**

Building's Current Water Conservation

Code-Required Low - flush toilets that don't necessarily conserve water

Conventional Supply Fixtures Estimates

Fixture	Total FU	GPF
Lavatory	26	975
Urinal	30	1,125
Toilets	95	3,563
Service Sink	6	225
Water Fountain	2.5	94

GPF = (GPFU) (FU)

GPF = gallons/day/fixture

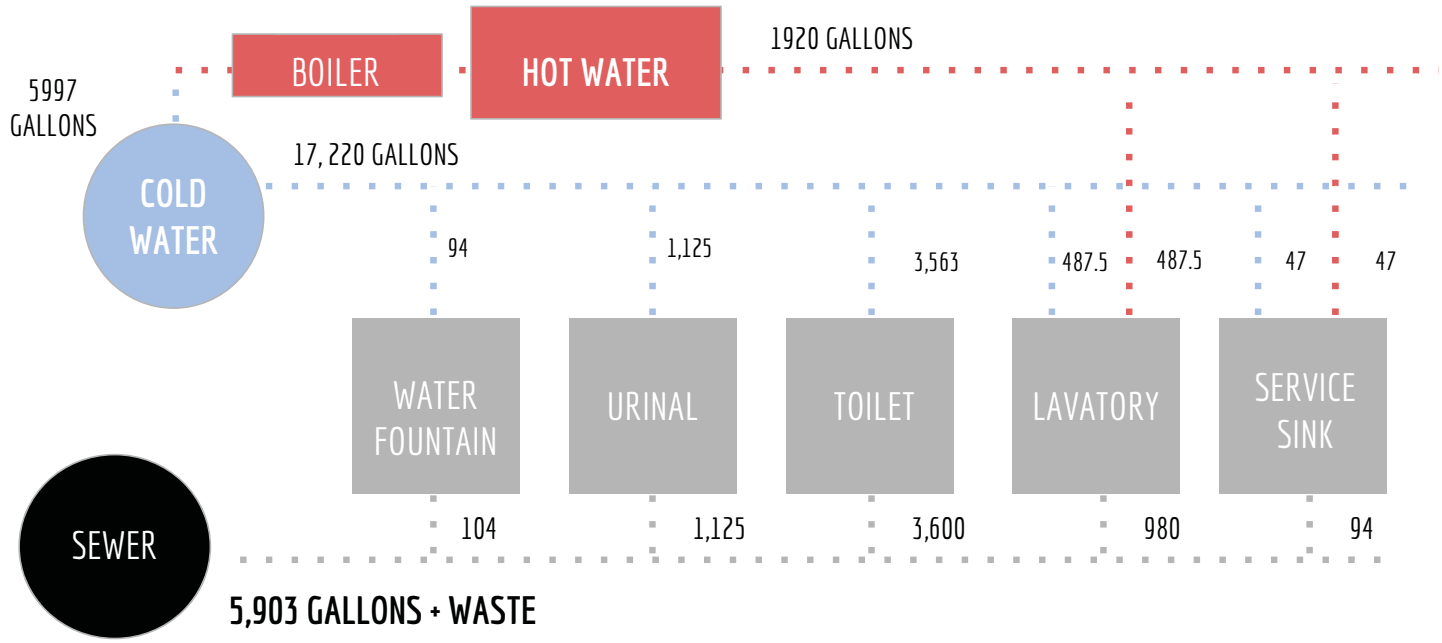
GPFU = gallons/day/supply fixture unit

FU = weight in supply fixture units

Total Supply: 5,997 gallons/day

(MEEB TABLE 19.15)

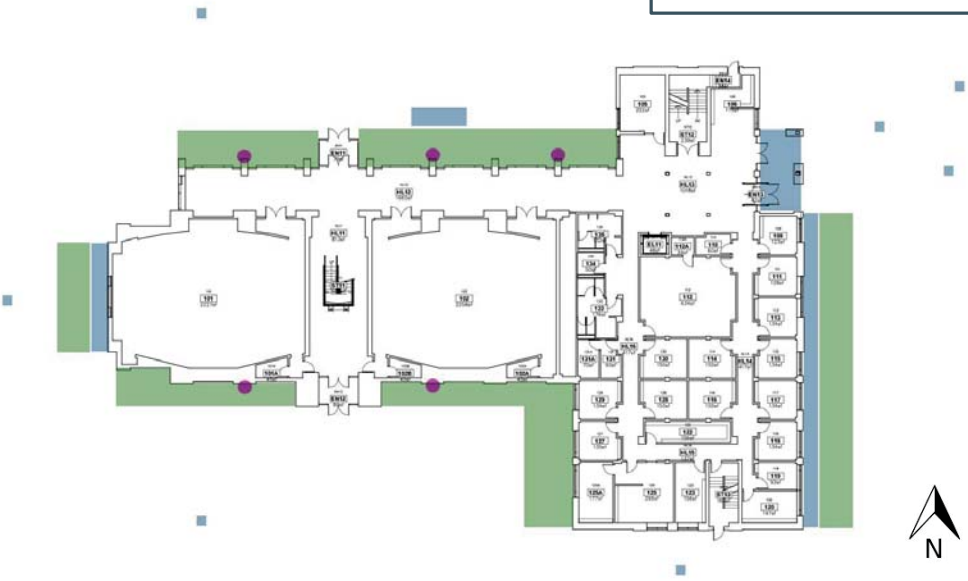
System Diagram



Stormwater Analysis

Stormwater Device Inventory

5 Downspouts
11 Drains
7 Infiltration Planter Beds



Garden Beds Storm Drain Roof Downspout

Monthly Rainfall in Moscow ID

The only stormwater retained on site is used on the garden beds along the edge of the building. But it doesn't rain enough in Moscow to keep the garden beds watered during growing season, so additional irrigation is required. The rest of the water is drained to the sewer.

SEASON	• PRECIP (IN)
Annual	27.07
Winter	8.49
Summer	3.85
Spring	7.74
Autumn	6.99

Monthly Average: 2.26 in.

MONTH	• PRECIP (IN)
01	3.14
02	2.37
03	2.69
04	2.52
05	2.53
06	1.88
07	0.97
08	1.00
09	1.21
10	2.17
11	3.61
12	2.98

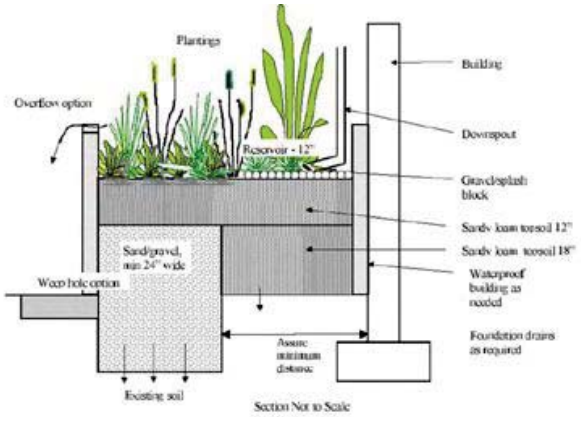
Water Use Redesign

Storm Water Conservation Re-Design

Problem: All stormwater is drained directly into the city sewer, and only sufficiently irrigates the garden beds for 2 months out of the year.

Strategy: All stormwater grates will drain into a cistern to be filtered and reused. Roof downspouts will filter through the garden beds and be drained into the cistern below the beds.

Bottom Line: Cistern will collect and reuse all collected stormwater.



Water Conservation Re-Design

Strategies

Waterless Urinal
Ultra-low Flush Toilets
Motion Sensor Faucets
Cistern

Monitor water flow, reduce water use and utilize stormwater and greywater stored in cistern

Fixture	Type	Number	Cold	Hot	WSFU	Total Fixture Units
Lavatories	Motion Sinks	13	0.5	0.5	0.7	9.1
Urinals	Waterless	6	0	0	0	0
Toilets	Ultra-Low Flush (water supplied by the cistern)	19	0	0	0	0
Service Sink		2	2.25	2.25	3	6
Water Fountain		10	0.25	0	0.25	2.5
Total		**Total = 50**				**Total (FU) = 17.6**

Before Redesign: 159.5 Total FU
Redesign: 17.6 FU

Savings = 141.9 FU

Water Conservation Re-Design

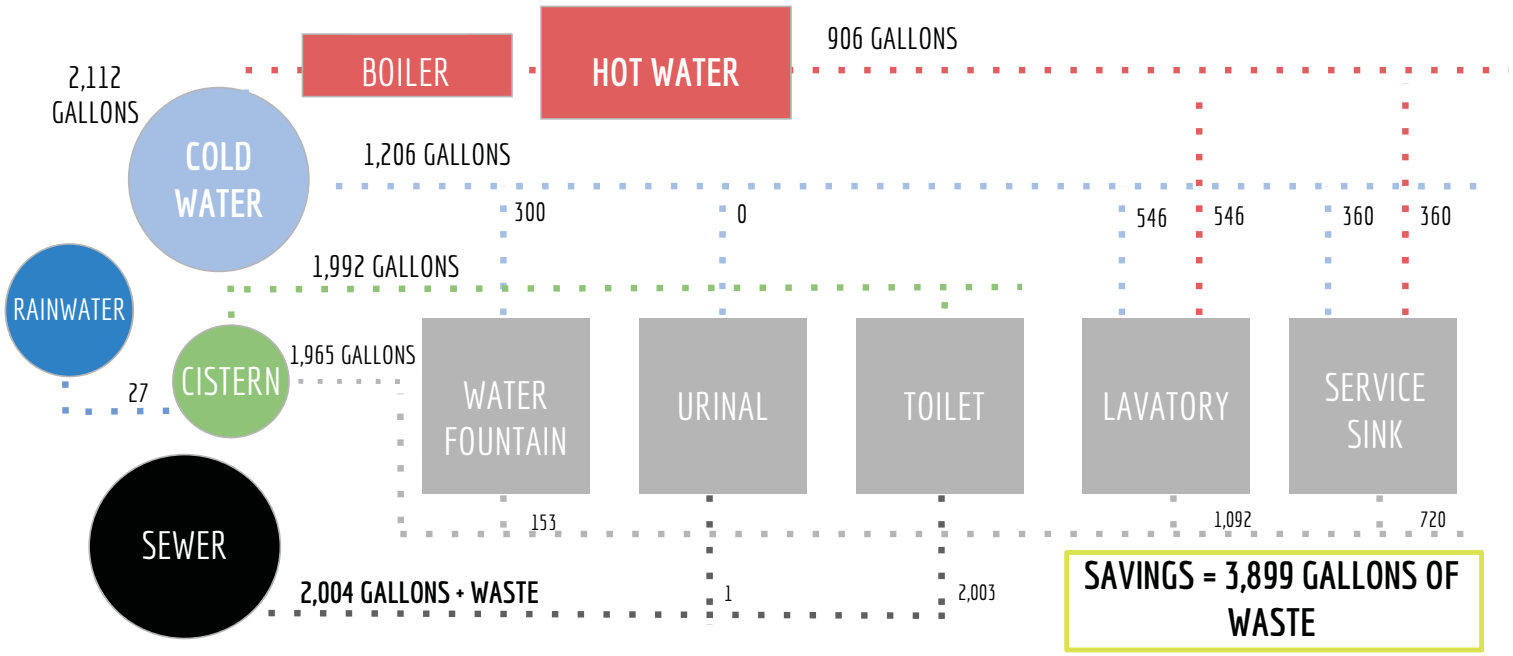
Before the Redesign:
5,997 gallons/day (GPF)

Redesign:
2,112 gallons/day (GPF)

SAVINGS:
3,885 gallons/day

Fixture	Total FU	GPF
Lavatories	9.1	1,092
Urinals	0	0
Toilets	0	0
Service Sink	6	720
Water Fountain	2.5	300
		Total = 2,112

System Redesign Diagram



Cistern Design

G = [(P)(A)] / (2.15)

G = annual rainfall collected

P = total precipitation

A = roof catchment area

G = (27.07) (10,602) / (2.15)

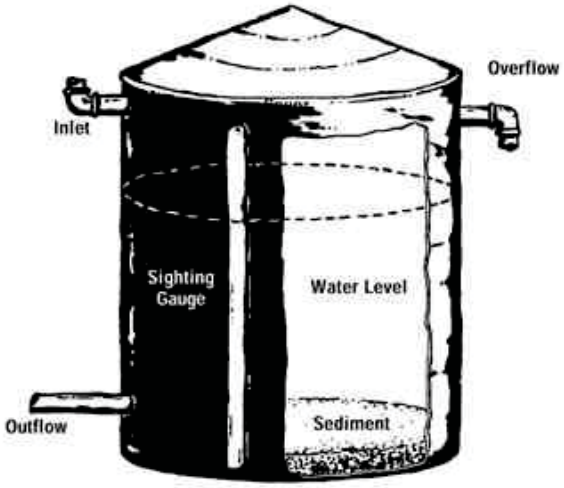
Average Annual Rainfall Catchment = 133,487 gallons

Average Monthly Rainfall Catchment = 11,124

If average monthly use exceeds the average monthly catchment,
G = 2C
C = average monthly catchment

G = 2(11,124)

Cistern Sizing Estimate = 22,248 gallons



V = G / (7.48)

V = (22,248) / (7.48)

Cistern Volume = 2,974.3 (ft^3)

Underground Cistern Dimensions

Cylinder with radius of 7' and height of 20'

Performance Analysis

Conventional Water Usage per year = **6,986,100 gallons**

Re-design Usage per Year = **770,880 gallons**

Saves 89% per year

Saves approximately 17,028 gallons a day from previous design

Conclusion

Existing Water Conservation Strategies:
Low Flush Toilets

Problems with Existing System:
All water from fixtures goes directly to sewer system

Existing Water Usage: **5,997 gallons/day**

Redesign Water Conservation Strategies:
Low flush toilets, no-flush urinals, gray water storage and reuse

Redesign Water Usage: **2,112 gallons/day**

Savings: **3,885 gallons/day**