

Case Study #2

Site & Building Water Use



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Building Description

The building being analyzed for this project is Art & Architecture South at the University of Idaho.

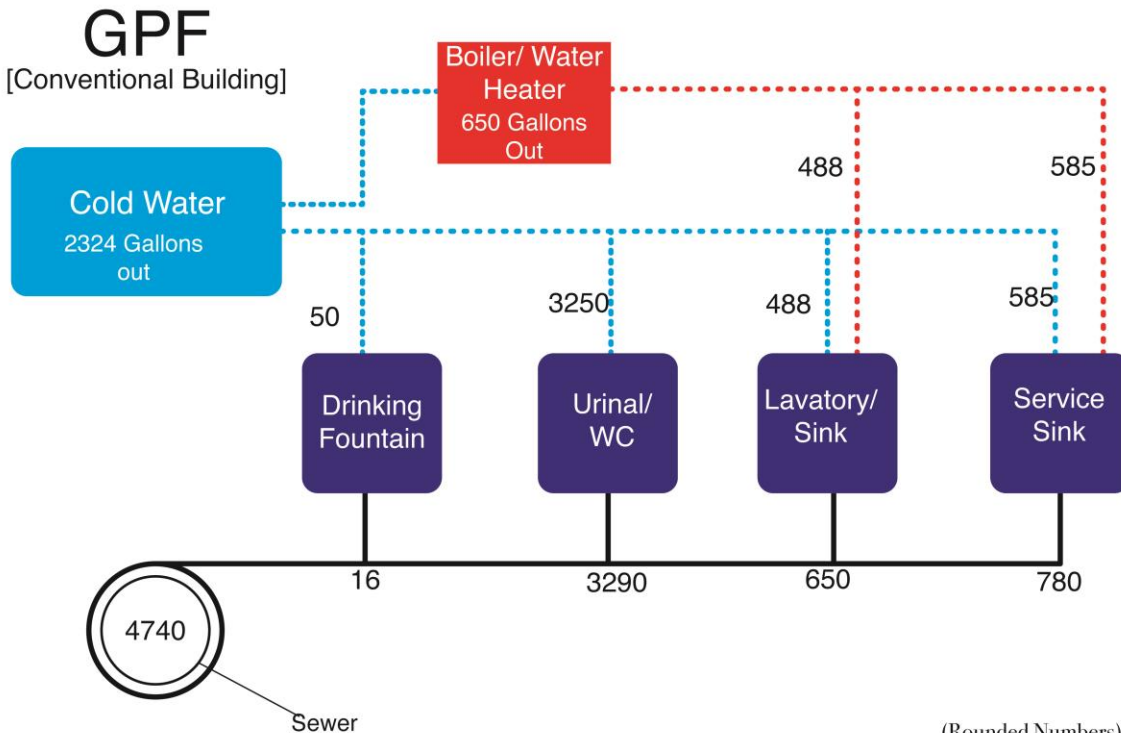
- Classified as an educational building according to MEEB [table 21.15](#)
- Occupancy at peak time is **100 persons**
 - According to MEEB [Table 20.3](#)
 - One bathroom per 50 persons is needed
 - One lavatory per 100 persons is needed
 - One drinking fountain per 100 persons is needed
 - One service sink per 100 persons is needed
- The building's fixtures include...
 - Five bathrooms
 - Five toilets
 - Five urinals
 - Five lavatories
 - Three **Service Sinks**
 - Two Drinking Fountains
- Building features exceed minimum requirements



Water Conservation

[Conventional]

- The Current state of the building's water conservation
 - The fixtures are low flow, but other than that nothing is being conserved.



Conventional

From section D4.1-4.2 in "Inside Out"

Peak Hour Occupant Load: 100

Estimated Gallons/Day: 15 (MEEB Table 20.2)

Total Gallons/Day: (100)(15) = **1500 (WU)**

GPFU: (WU/FU) = 1500/22 = **65 gallons/fixture**

FIXTURE TYPE	NUMBER	FIXTURE UNITS (FU)	GPF (GPFU)(FU)(#Fixtures)
Toilets	5	5	1625
Urinals	5	5	1625
Service Sink	4	3	780
Lavatory Sink	5	2	650
Water Fountain	3	0.25	48.75
TOTAL	22		4,730 Gallons per day

(Rounded Numbers)

Water Conservation

[Conventional]
Cont.

GPF

[Conventional Building]

Cold Water
2324 Gallons
out

**Boiler/ Water
Heater**
650 Gallons
Out

50

Drinking
Fountain

16

3250

Urinal/
WC

3290

488

Lavatory/
Sink

650

488

585

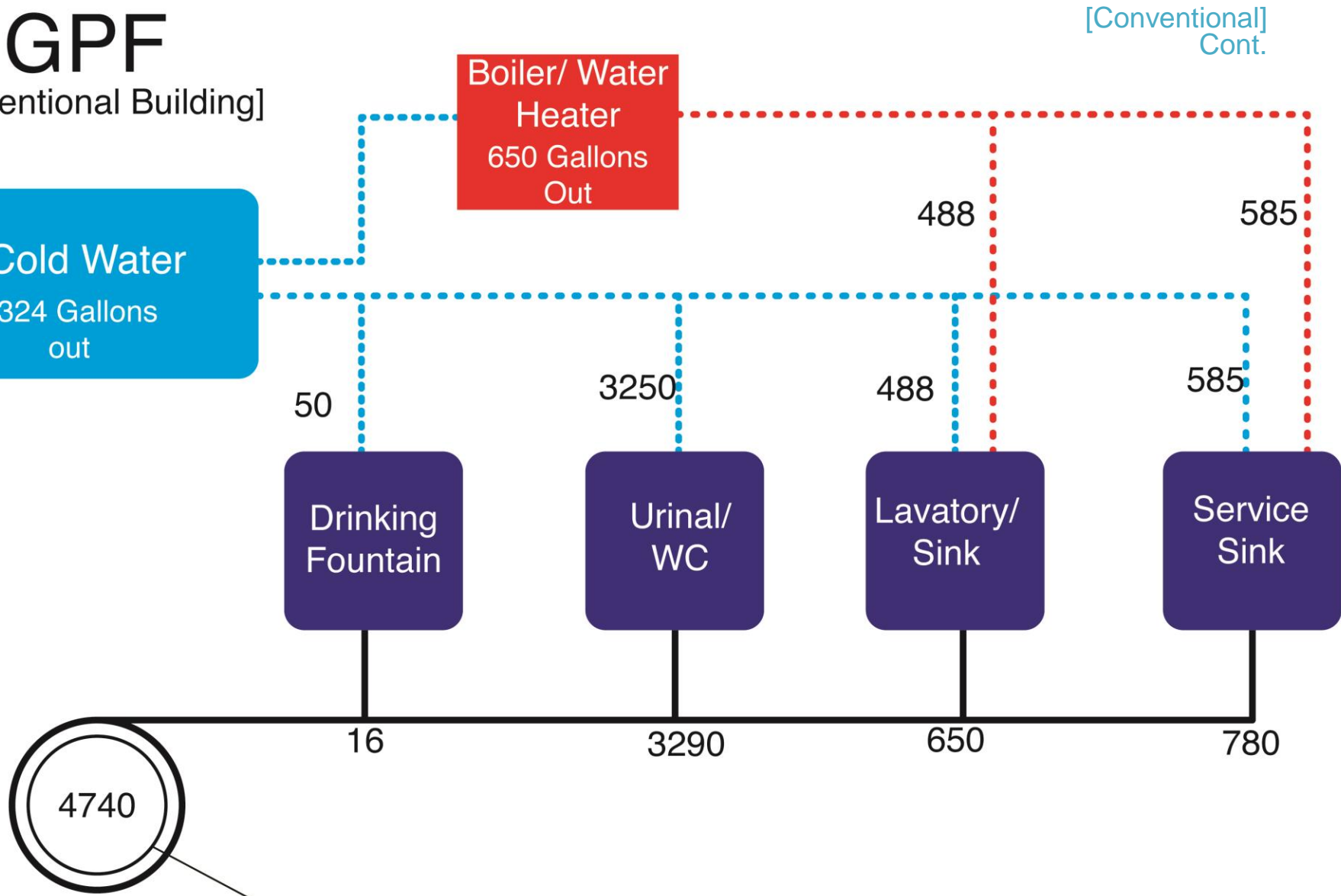
Service
Sink

780

4740

Sewer

(Rounded Numbers)



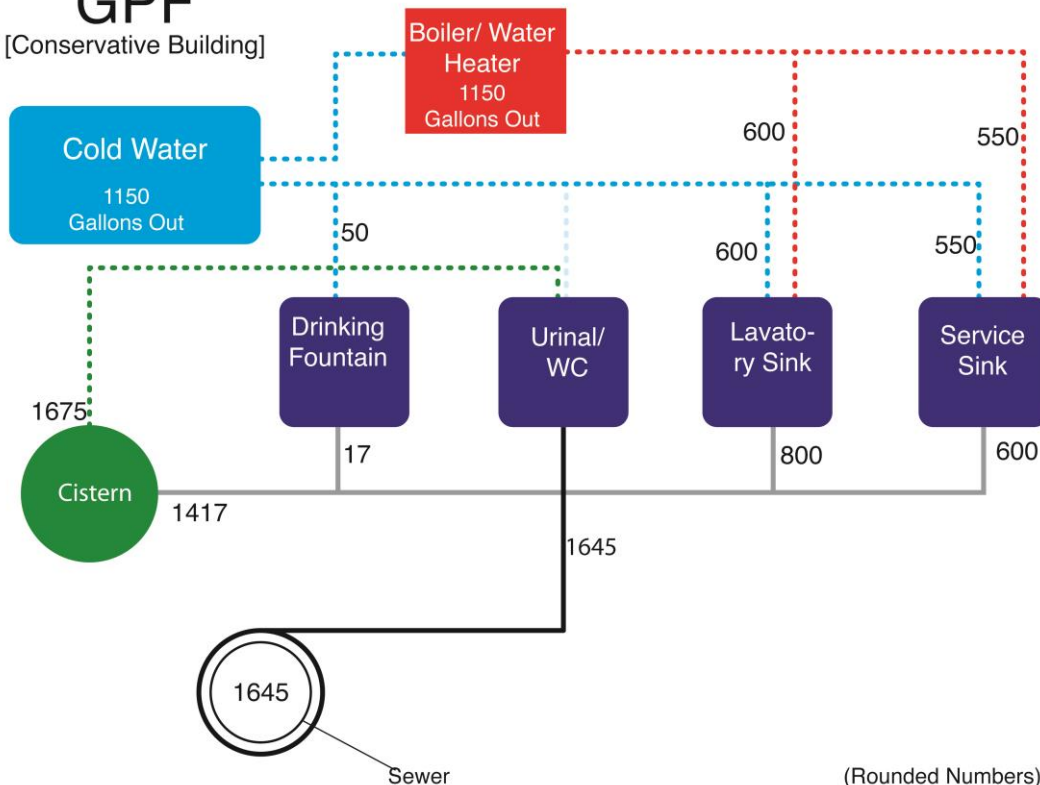
Water Conservation

[Conservative]

- For the redesign, Eco Trap urinals are being used, which results in no water being needed for them
- The grey water is now being utilized and stored in a cistern.
- As you can see, with 1417 gallons of water being introduced from grey water, the toilets only need about 300 gallons per day to function. (this will be made up for with storm water)

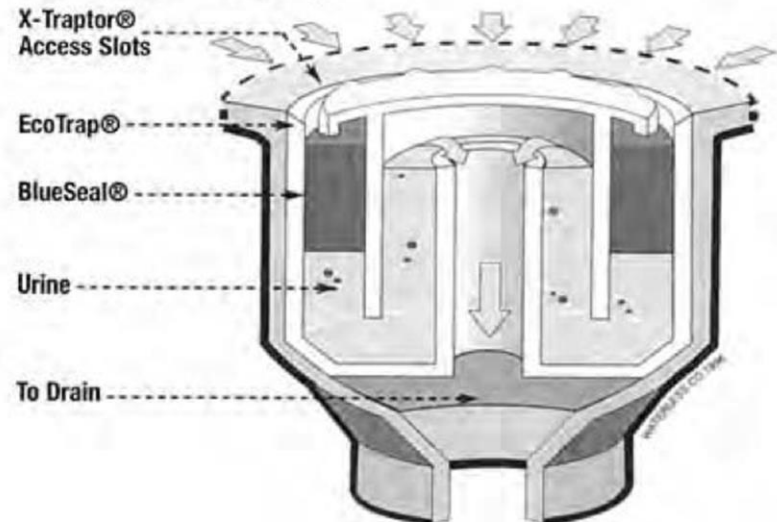
GPF

[Conservative Building]



(Rounded Numbers)

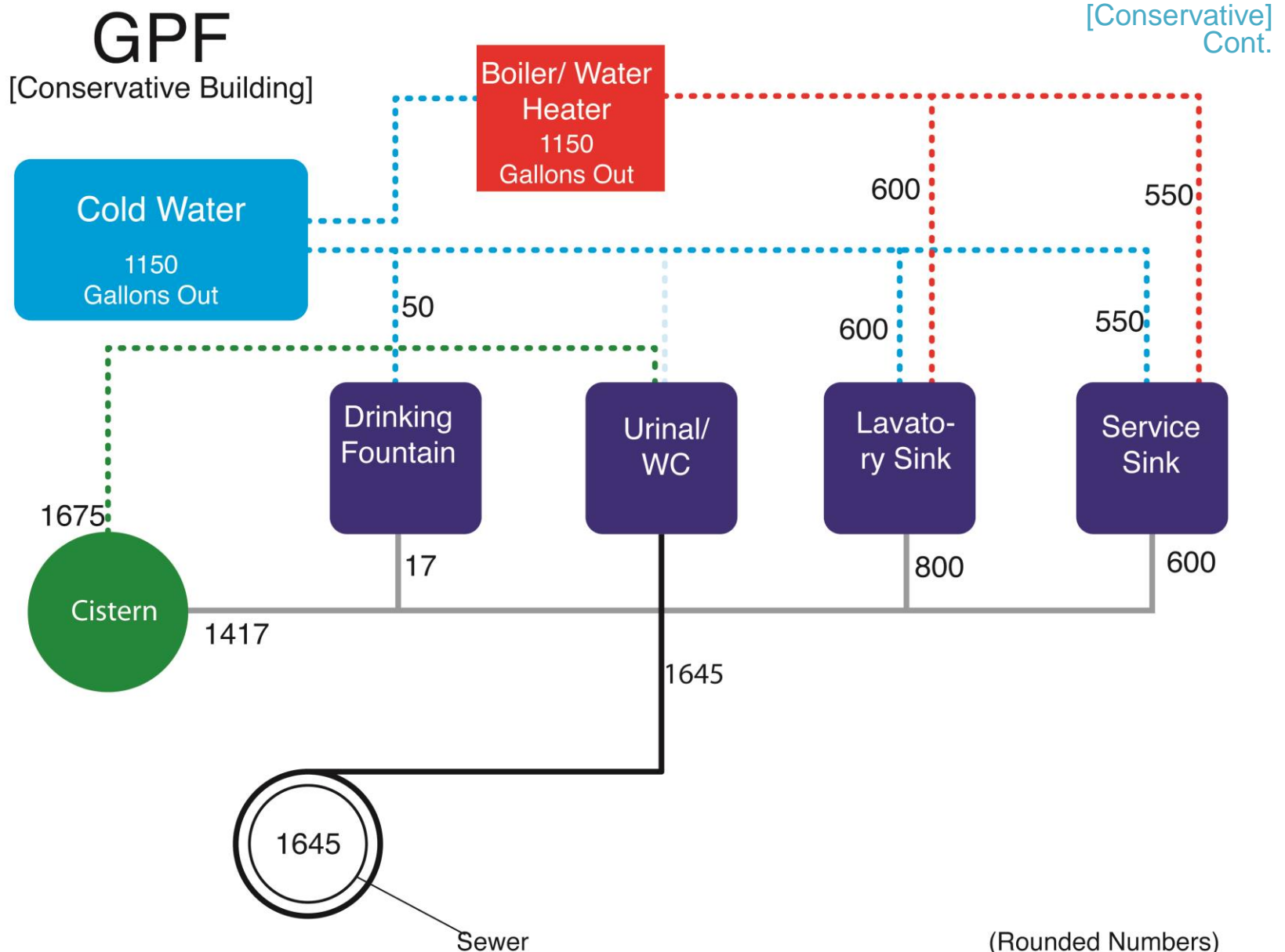
Cross Section of EcoTrap®



(b)

From MEEB Figure 22.7

Water Conservation



Water Conservation

[Conservative] Cont.

- With a redesign of adding a cistern, using waterless urinals, and using grey water effectively, we were able to reduce water consumption per day by **60%**
 - Before the redesign the daily water use was **4,730 gallons**.
 - After the redesign, the daily water use is **1450 gallons** per day
- Based on the Educational Function use, we were also able to take out a bathroom and a water fountain to reduce the amount of water being used.

Conservation

From section D4.1-4.2 in "Inside Out"

Peak Hour Occupant Load: 100

Estimated Gallons/Day: 15 (MEEB Table 20.2)

Total Gallons/Day: $(100)(15) = \mathbf{1500 (WU)}$

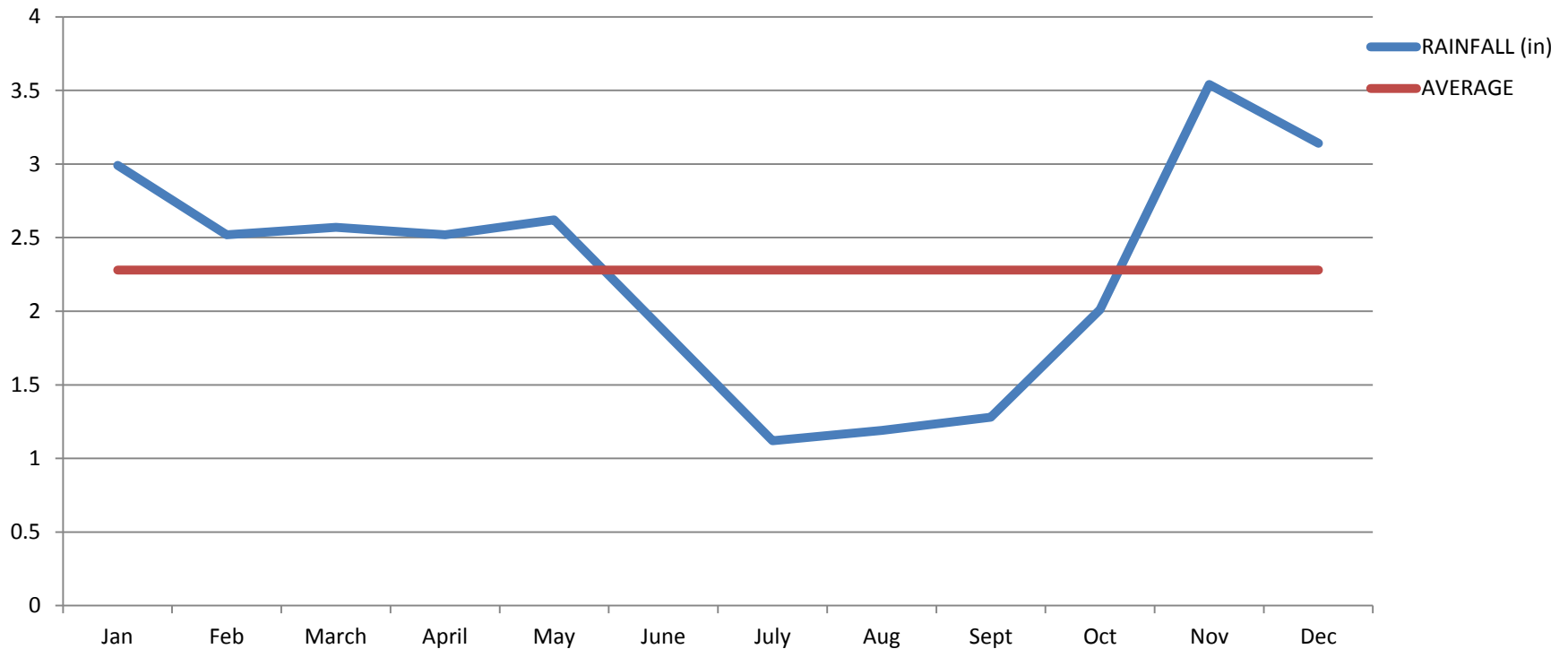
GPFU: $(WU/FU) = 1500/15 = \mathbf{100 \text{ gallons/fixture}}$

FIXTURE TYPE	NUMBER	FIXTURE UNITS (FU)	GPF (GPFU)(FU)(#Fixtures)
Toilets	4	0	0
Urinals	3	0	0
Service Sink	2	3	300
Lavatory Sink	4	2	200
Water Fountain	2	0.25	25
TOTAL	15		1,450

Storm Water

[Site Information]

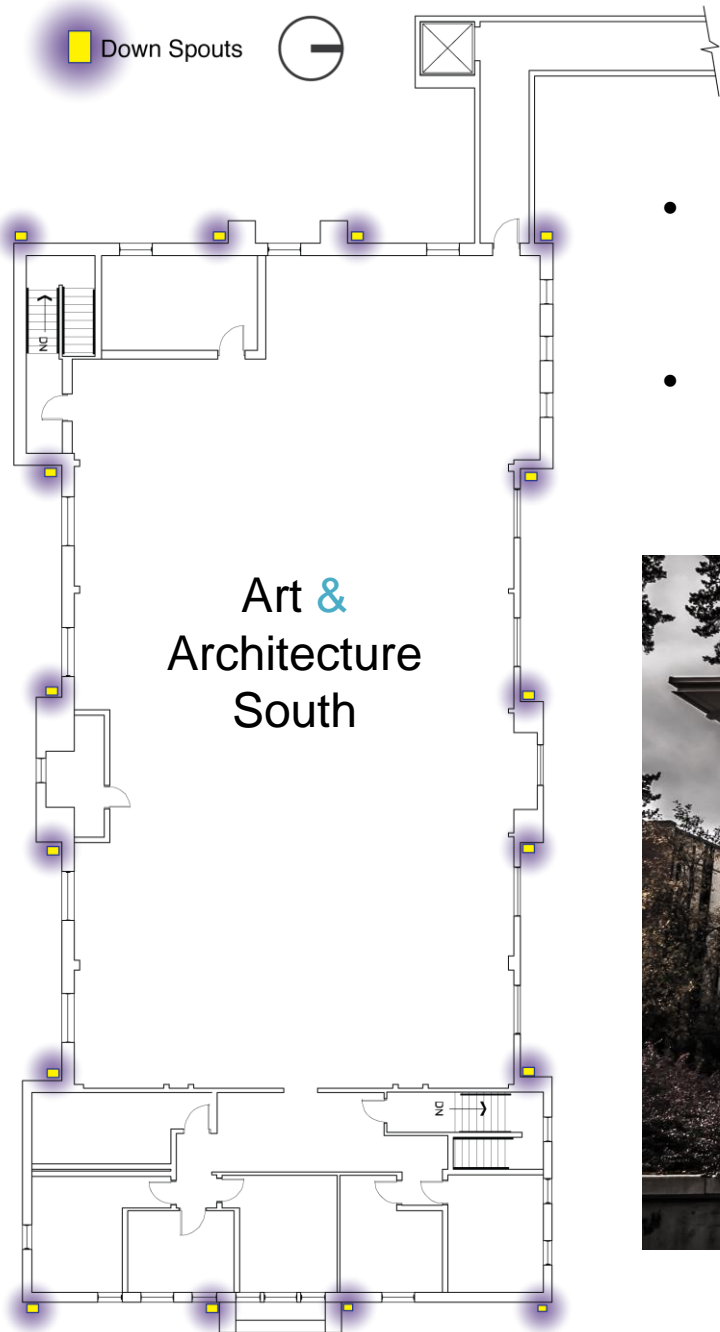
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
RAINFALL (in)	2.99	2.52	2.57	2.52	2.62	1.87	1.12	1.19	1.28	2.01	3.54	3.14
AVERAGE	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28



- Information from <http://hurricane.ncdc.noaa.gov/climatenormals/clim81/IDnorm.pdf>
 - Page 14

Storm Water

Cont.



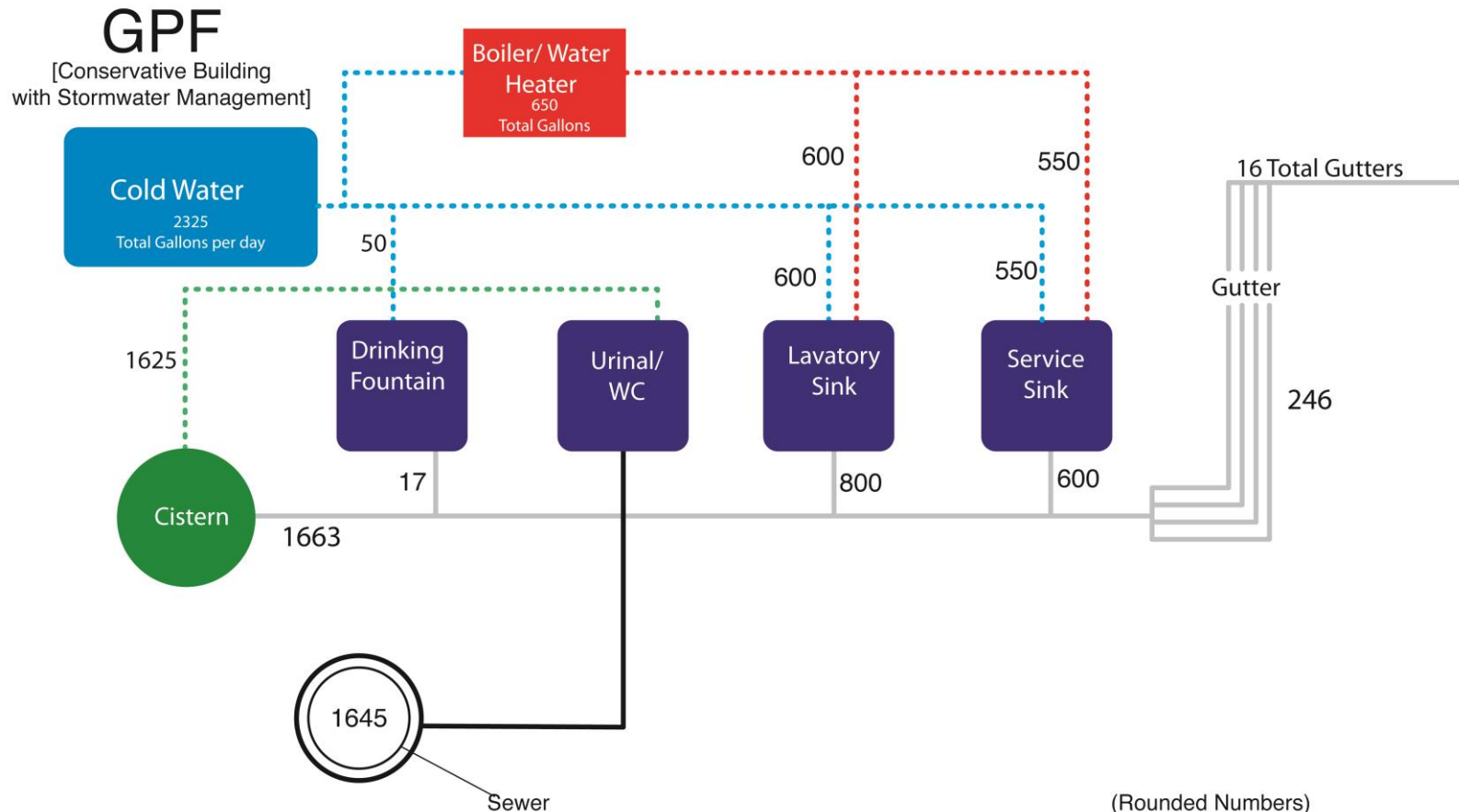
- The Art & Architecture South building has **16 down spouts** that lead either into the ground or into the plant beds.
- The roof is about **7200 square feet**, which is the number that we will be using for the rest of the calculations



Water Use Redesign

[for better water conservation and storm water management]

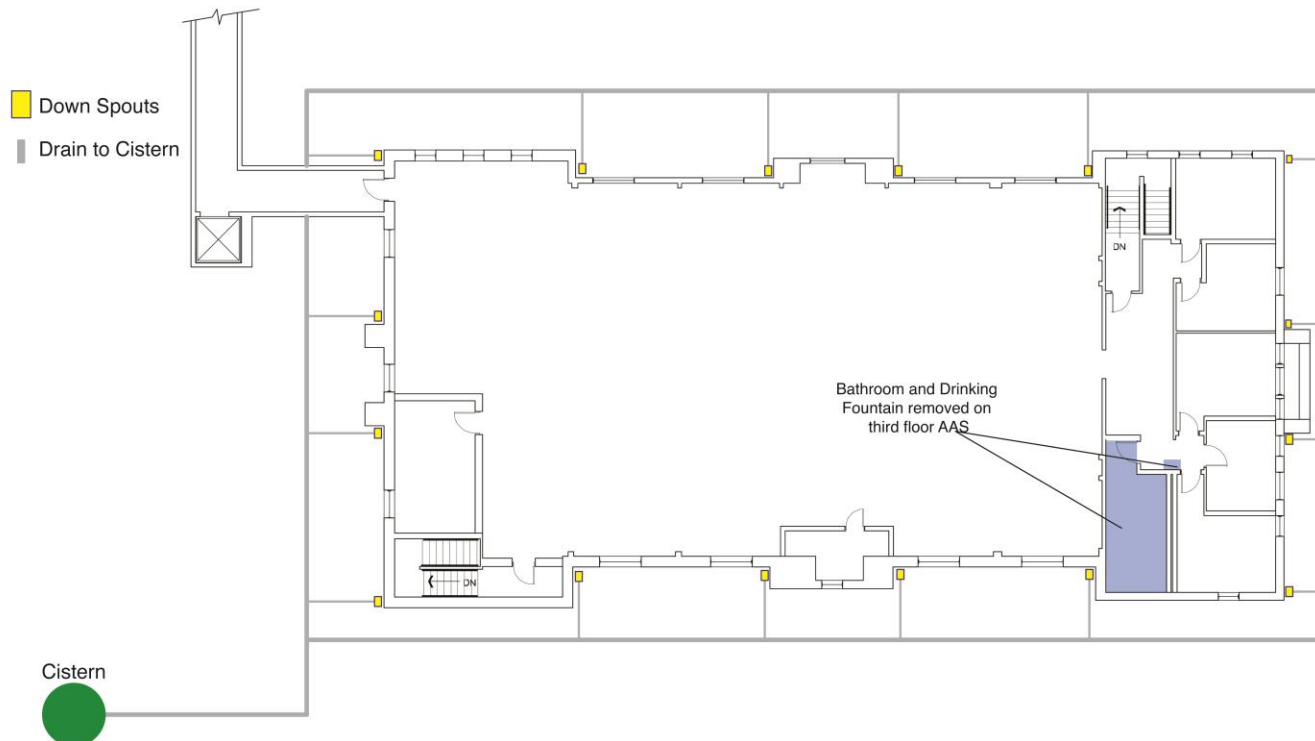
- For the redesign we have decided to go with a Cistern, along with dual flush toilets and no water urinals.
- We were also able to remove a bathroom and a water fountain, again reducing the amount of water being used throughout the building



Water Use Redesign

[for better water conservation and storm water management]
Cont.

- Cistern Design [from *Inside out section d4.5*]
 - $G = [(P)(A)] / (2.15) = [(27.27)(7200)] / 2.15 = 91,658$ Gallons Per year from storm water management.
 - $G = (U)(1.5) = (8000)(1.5) = 12,000$ gallons
 - $V = (G) / 7.48 = 16000$ Ft.³
 - This means that the cistern needs to be 5 feet in length with a diameter of 2 feet (rounded)



Performance Analysis

[Redesign]

- The conventional water usage per year is 1,726,450 gallons
- With conservation water usage, 611,375 gallons are used per year
 - This saves about 60% water
- With the redesign, utilizing grey water, storm water, and reducing the number of fixtures, the yearly water usage is now 17,842 gallons per year!
- This means that 99% of water will be saved with the redesign!
- Numbers
 - 611,375 gallons used per year, where 517,205 are used from grey water, leaving 109,500 to be accounted for. With 7200 square feet of roof space, and an average monthly rain fall of 2.28 inches, it gives us 91,658 gallons of storm water per year, making the deficit of 17,842 gallons of water that is needed from other means per year. Great!

Conclusion

Problems

The amount of fixtures is more than double the necessary number for this building type & occupancy

All water from fixtures directly enters the sewer system (not recycled)

Irrigation is the only use for storm water

Conservation Methods: 

60% of Water Saved

Decrease number of fixtures

Installing Eco trap urinals

Capture grey water from sinks and fountains

→ Use in toilets

Addition of cistern to hold grey water

Storm Water Management: 

99% Total Water Savings

Original Design: 1,726,450 gallons used per year
Redesign: 17,842 gallons used per year

Rainwater catchment from 16 downspouts

→ Store in cistern, Use in toilets

Work Cited

- MEEB
 - Tables 20.3 & 21.15
- Inside Out
 - A4-E4
- <http://hurricane.ncdc.noaa.gov/climatenormals/clim81/IDnorm.pdf>