APSC 101 CAPSTONE



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RAINWATER HARVESTING SYSTEM

Photo source: textureX.com





LAYOUT A



LAYOUT A



PUMP A



layout **B**



Additional Height Increased Potential Pressure

Increased Piping Increased Pressure Loss



LAYOUT **C**

STORAGE TANK

CATCHMENT

- Catchment on top
- No pump required
- No collection tank required
- No roof collection area
- More expensive collection area
- Purely relies on gravity

STUDY PROBLEM

SATISFACTION WEIGHTS



- Consumption
- Relative Cost
- Environmental
- Maintenance Occurance
- On Demand Flowrate
- Reliability

Used excel to find solutions with the best satisfaction

Used real testing and prototyping via experiments



OBLEM > IDENTIFY SOLUTION > TEST & IMPLEMENT

<u>nt</u>	Description	<u>Input</u>	Units	
	Target Consumption	560	L/day	Satisfaction Preview
	None (none)			63.56%
	Half Roof (half)	full		
	Whole Roof (whole)			
:hment	y/n	yes	es	120
	Area	ட ு50	m^2	
	location (x)	10	m	
	location (y)	10	m	100
	location (z)	2	m	
⁻ ask	None (none)			80
	400L (SM)			
	1500L (MD)	SM		60 —
	2500L (LG)			
	10000L (XL)			40
ink	Volume	42	m^3	
	location (x)	10	m	
	location (y)	5	m	
	location (z)	5	m	O ANNUALLY, AND LARDERS I AND
er	y/n	no		
	Tower height	0	m	





WATER CONSUMPTION



COLLECTION AREA





Layout C

- Uses roof and additional area
- Small area
- Less expensive

- Only additional area
- Located higher
- Farther more pressure loss
- More Expensive



COLLECTION AND STORAGE TANK







- Options in fixed increments, must satisfy volume
- Must be greater than consumption to prevent overflow and satisfy needs
- Defines maximum Q in for the system of days





- Pay per unit of volume, remainder from Total Tank Size
- Cost the minimum possible in order to maintain water in system during low rainfall periods



Total expense with identical parameters



PUMP CHOICE





B







FILTERS





FILTER DIRECTION



UV DISINFECTION SYSTEM



- Highest flow rate 35 LPM
- Does not limit on-demand flowrate
- Placed downstream
- Same replacement time compared to 36W
- More expensive
- Increased energy usage

Energy Required by System

- Energy to pump and filter water
- Energy to convert current from DC to AC (Inverter)
- Divided out by energy inefficiencies



Calculating Power Out

- Pump Power: Dependent on Water collected in Catchment Tank
- Inverter: Runs with Pump
- UV: Constant Power of 4500 kJ/day

Total Electrical Energy Used: 4500 kJ/day < Energy < 5400 kJ/day **Calculating Power In**

Six Solar Panels : 5400 kJ/day

One Battery : 7200 kJ/day



ON DEMAND FLOW RATE



- Still has high satisfaction (99%)
- More expensive method required for 30 LPM

EXPENSES (5 YEARS)



ReplacementFilter – 75 Times/5CostsYears

Pump not expected to be replaced

Days Without Service

- \$75 per day to ship water
- 55 Days without water

Expense	Total Cost
Water Import	\$4 125

FINAL RECOMMENDATION





CONCLUSION

