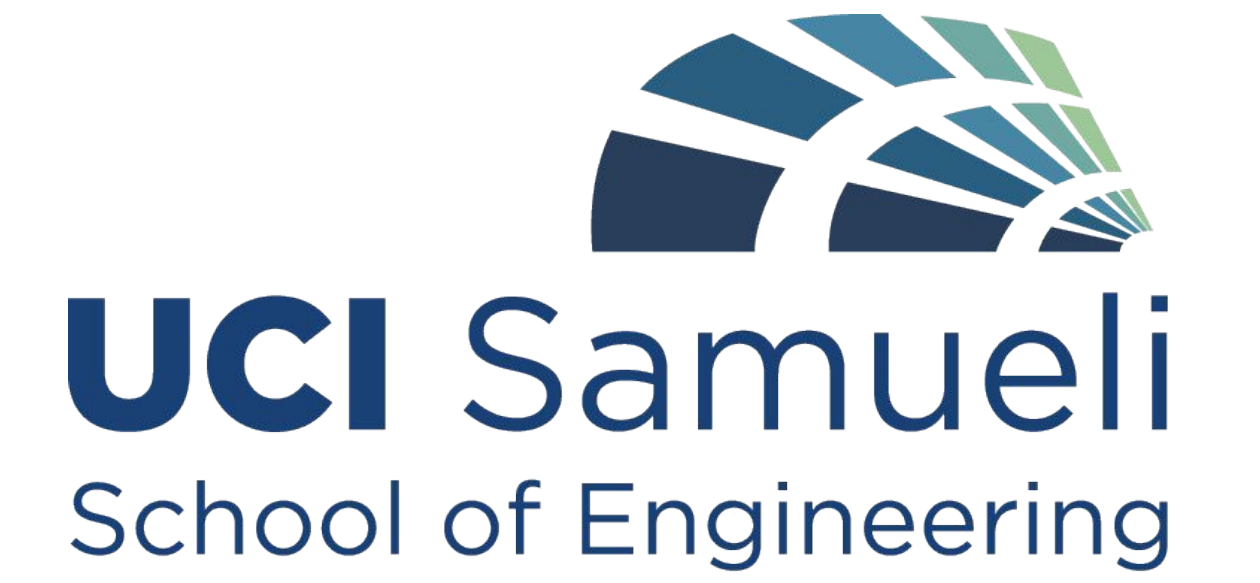


Sustainability Decathlon– Efficient Water Usage and Recycling for a Sustainable ADU

Team ThREe: Haoming Huang, Jadzia Davidson, Kripa Ramakrishnan, Seth Roberts, Wenhan Ji


Sponsors: Professor Walter & Alexandra Huff




Executive Summary:

We worked to reduce the average per day water usage of an individual by 20 gallons per day. This was achieved by applying low flow fixtures for household appliances. This will effectively reduce water consumption by over 17 gallons per person per day. We also designed a grey water recycling system that will take the water produced by the shower, bathroom sink, and washing machine, pass it through a series of filters, and divert it for use as irrigation and for the toilet. This would reduce the water used per day per person by an additional 6 gallons, bringing our water saving totals to around 24 gallons per day.


Fixtures:



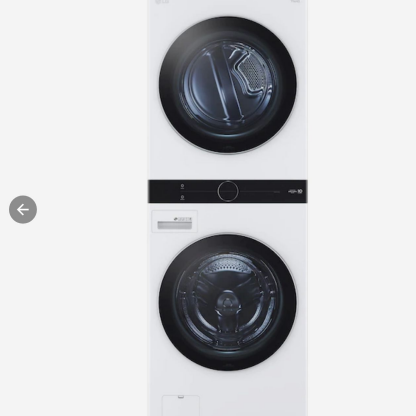
Delta Foundations 2-piece 1.28 GPF Single Flush Round Front Toilet^[1]




Fisher-paykel DD24SAX9 24in. Full Drawers Console Dishwasher




Shower Boss ShowerTimer Residential unit




LG WashTower Electric Stacked Laundry Center with 4.5-cu ft Washer and 7.4-cu ft Dryer^[4]




Niagara Conservations Sava 1-Spray Patterns 4.5 in. Single Wall Mount 1.5 GPM Fixed Shower Head



Bau Cosmopolitan Battery Powered Single Hole Touchless Bathroom Faucet^[2]



Jeonestan Foot Pedal Faucet Set, Touchless Floor Mount Foot Control Faucet Kit^[3]



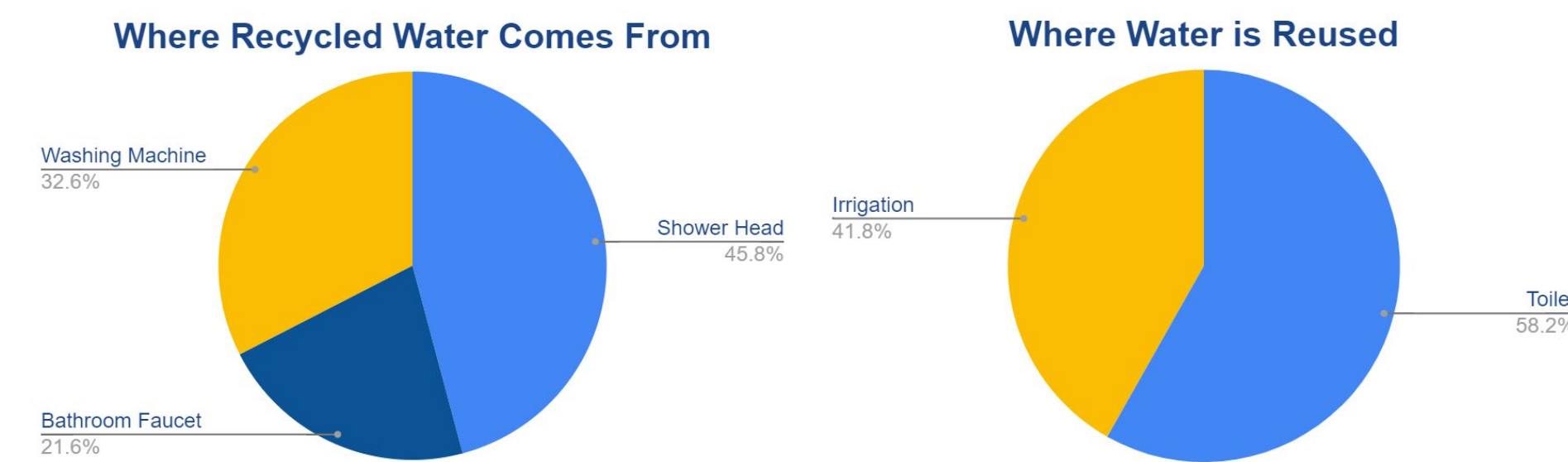
0.5 Gallons per Minute Sink Faucet Aerator

Water Savings:

- From Fixtures: 141.54 gal/day

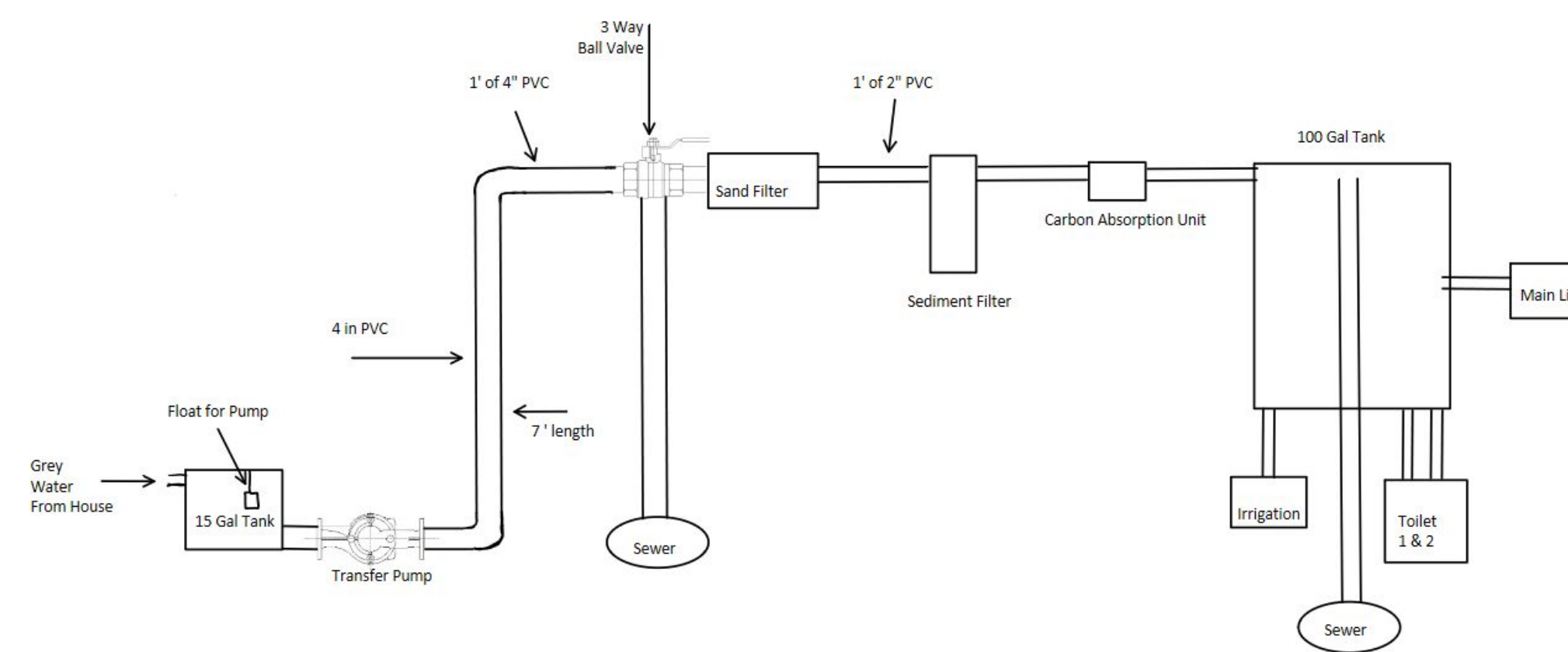
Appliance	Average Fixture (gal/day)	Water-Saving Fixture (gal/day)
Toilet	8.32	6.66
Shower head	12.50	7.50
Faucet	10.89	2.48
Dishwasher	3.93	2.75
Washing Machine	5.43	4.00
Total for 8 People	328.59	187.05

- From Recycling: 91.5 gal/day



- Total Savings: 233.04 gal/day

Schematic:



Soaps & Detergents:

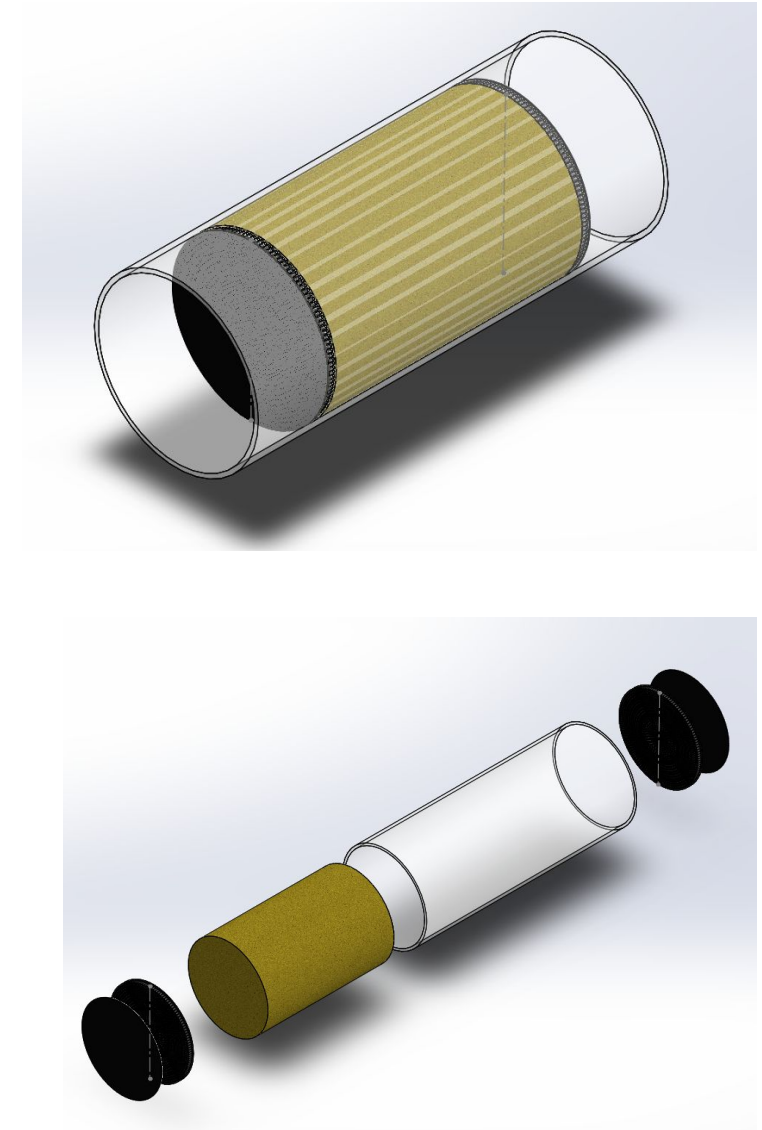
- What to Avoid:
 - Salt and Sodium Compounds
 - Boron
 - Chlorine Bleach
 - Alkaline Compounds
- Safe Brands
 - Dr. Bronner
 - Oasis



Filters:

Sand:

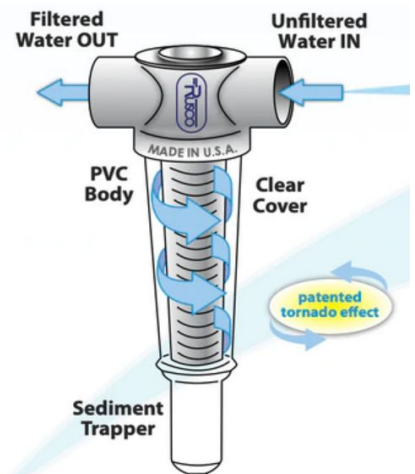
- Used for primary treatment of water
- Modeled off of the the Showerloop system and pool sand filters
- Sand is compressed in a geotextile fabric bag for further filtration and easy maintenance
- Components:
 - Acrylic Tube
 - Geotextile Fabric
 - Acrylic Compression Disks
 - Quartz Sand
 - PVC Caps



Flow rate	Micron rating	Initial Cost	Replacement Cost	Lifespan
2.6 gpm	20	\$85	\$30	1-2 years

Rusco "Spin-Down Sediment Trapper"^[5]:

- Removes very small particles
- Rusco's "Spin Down" technology allows for no replacement costs
- Light shield prevents algae growth



Max Flow Rate	Micron Rating	Initial Cost	Replacement Cost	Time btwn cleaning
18 gal/min	15	\$92	\$0	~1 month emptying ~1 year rinse mesh filter

"Big Blue" Carbon Block Filter^[6]:

- Removes Volatile Organic Chemicals
- Micron rating is low enough to pair with drip irrigation without clogging
- Filter replaced annually



Max Flow Rate	Micron Rating	Initial Cost	Replacement Cost	Lifespan
4 gal/min	5	\$50	\$25	1 year

References:

[1] Aaron1980, et al. "Round Front Toilet in White." *Round Front Toilet in White C41913-WH* | Delta Faucet, 21 Nov. 2022. <https://www.deltafaucet.com/bathroom/product/C41913-WH.html>.
 [2] "E Touchless Electronic Faucet with Temperature Control Lever Battery Powered." QA, <https://www.grohe.us/Commercial-Bathroom-Faucets/E-Touchless-Electronic-Faucet-with-Temperature-Control-Lever-Battery-Powered/GROHE-CHROME-36468000>.
 [3] Amazon.com: Foot Operated Faucet. <https://www.amazon.com/foot-operated-faucet/s?k=foot+operated+faucet>.
 [4] Eamar, et al. "Front Load LG Washtower™ with Electric Dryer WKEX200HBA." LG USA, 4 Dec. 2022. <https://www.lg.com/us/washer-dryer-combos/ig-wkex200hba-washtower>.
 [5] "2" Rusco Sediment Trapper." Rusco, <https://www.rusco.com/products/2-sediment-trapper> QA.
 [6] "Pentek 20." Fresh Water Systems, <https://www.freshwatersystems.com/products/pentek-20-big-blue-water-filter-housing-with-pressure-relief>.