

Calhoun Fields Learning Lab Rainwater Harvesting System



Operating Instructions & Parts Manual

Designed and Installed by Senior Biosystems Engineering Students

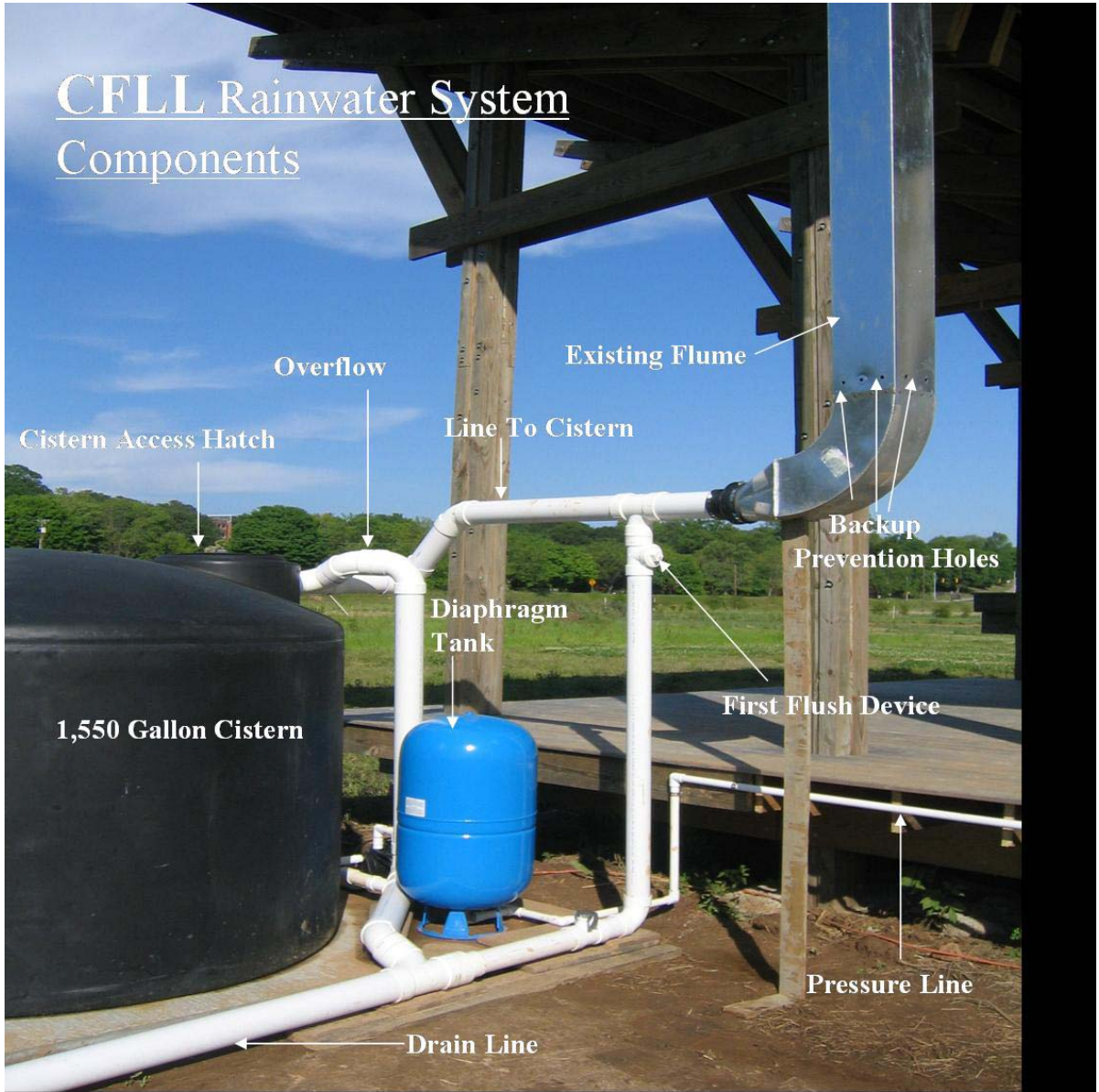
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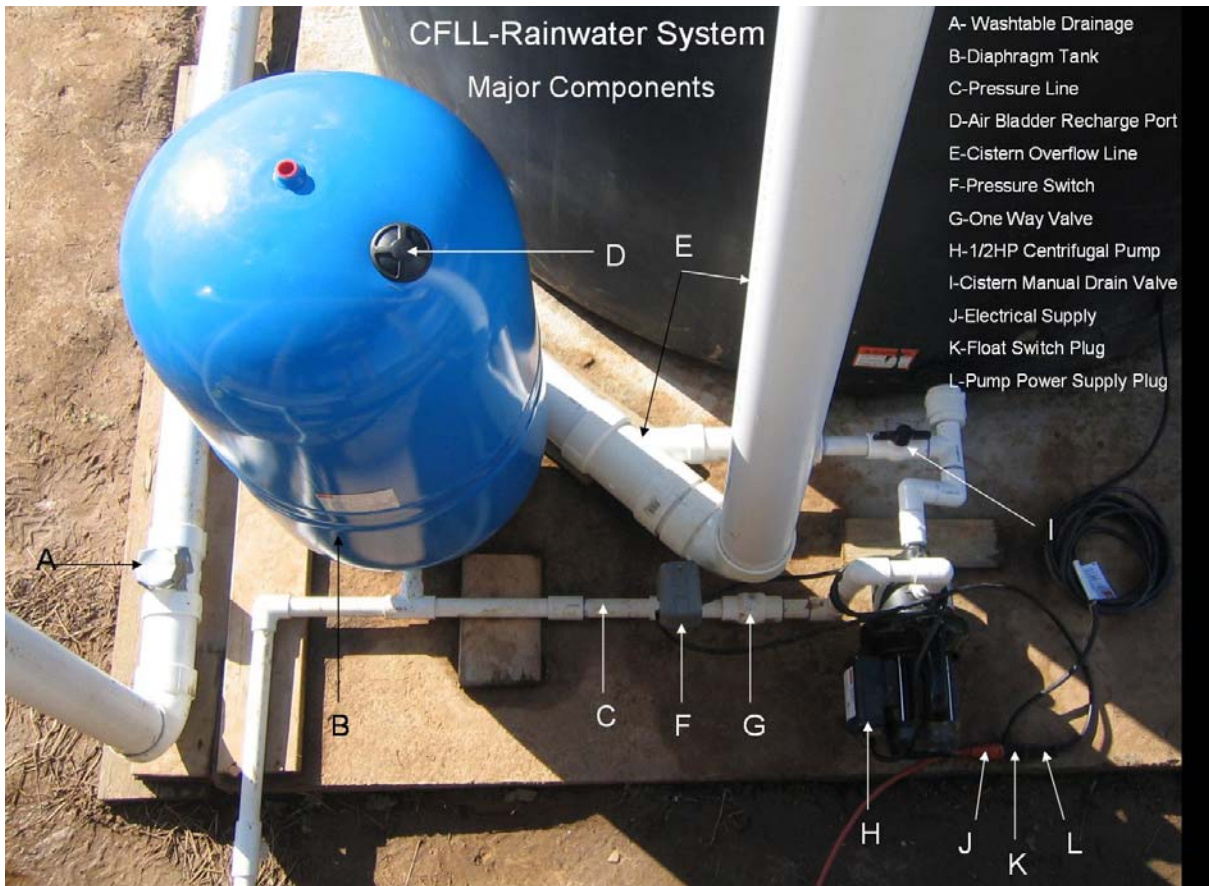
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Components

| Parts | Make | Model | Price | Source |
|------------------------------|-------------|---------------------------------|--------------|----------------|
| .5 HP Centrifugal Pump | Dayton | 3YU60 | \$130 | Grainger |
| One-Way Valve | PVC | | \$5 | Any home store |
| Diaphragm Tank | Dayton | 4MY61 | \$250 | Grainger |
| Cistern | ----- | 1550gal Polyethylene Water Tank | \$700 | Watertanks.com |
| Float Switch | Dayton | 3BY76 | \$105 | Grainger |
| Pressure Switch 30-50 PSI | Square-D | 9013FSG-2J21 | \$20 | Grainger |
| First Flush Device | FloTrue | K300-W-M | \$30 | FloTrue |

Component Function

-1/2 Horsepower Centrifugal Utility Pump provides the system pressure and flow for use of the water

-One Way Valve allows the pressure line to remain pressurized after the pump is off

-Diaphragm Tank allows for storage of pressurized water to prevent pump from cycling too often and extend pump life

-Cistern can store enough water for irrigating the area around the building for a three week drought

-Float Switch prevents pump from running the cistern dry which would damage pump

-Pressure Switch allows for on demand use of the system where the user does not have to turn the pump on and off

-First Flush Device allows for the first 35 gallons going directly to the drain line and cleaning the roof of debris to improve stored water quality

Operating Instructions

-For filling the tank and valve/wash table usage:

1. Access the first flush ball and spring by unscrewing the plate covering the access port. Make adjustment to the first flush valve to allow some water to enter the ball by rotating the plastic pieces covering the screens in the top of the ball. The amount of water flushed will decrease as the screen area covered by the plastic increases. Replace the plate covering the access port and screw hand tight.
2. Close the manual drain valve located near the tank outlet port. Also check that the pressure line drain plug and pump drain and fill plugs are in place.
3. Turn pump on (red switch on back of pump).
4. Use water as needed by opening the valves (valve knob will be vertical when open) located on the side of the building.

-For draining the tank:

1. Turn all valves located on the side of the building to the closed position (horizontal).
2. Turn the pump off (red switch on back of pump).
3. Open the tank drain valve located near the tank outlet port.

-For draining the pressure line:

1. Open the garden hose valve.
2. Remove pressure line drain plug.
3. Remove pump drain plug located below pump inlet.

System Capacity

Pump

The pump will flow a maximum of ~3.7 GPM at 40 psi. The pump is setup to operate between 40-60 psi.

Cistern-Storage Tank

The tank has a maximum capacity of 1550 gallons. Due to the location of the outlet port and float switches, the maximum usable capacity is ~1350 gallons. The water usage/storage data is tabulated in Table 1.

Table 1

1 Year Results Average Rainfall

| Month | Average Rainfall | Total Collected | Usage | Amount of Water Stored @ End of Month | Lost Water |
|---------------|-------------------------|------------------------|------------------|--|-------------------|
| | <i>(inches)</i> | <i>(gallons)</i> | <i>(gallons)</i> | <i>(gallons)</i> | <i>(gallons)</i> |
| January | 5.00 | 5984 | 0 | 0 | 4434 |
| February | 4.90 | 5864 | 0 | 0 | 5864 |
| March | 5.60 | 6702 | 2,000 | 1550 | 4702 |
| April | 4.3 | 5146 | 2,000 | 1550 | 3146 |
| May | 4.1 | 4907 | 2,000 | 1550 | 2907 |
| June | 3.9 | 4667 | 2,000 | 1550 | 2667 |
| July | 5.0 | 5984 | 2,000 | 1550 | 3984 |
| August | 4.8 | 5744 | 2,000 | 1550 | 3744 |
| September | 3.5 | 4189 | 2,000 | 1550 | 2189 |
| October | 3.7 | 4428 | 2,000 | 1550 | 2428 |
| November | 3.6 | 4308 | 2,000 | 1550 | 2,308 |
| December | 5.1 | 6103 | 0 | 0 | 6103 |
| Totals | 53.50 | 64025 | 18000 | | 44475 |

*Rainfall Data from <http://www.worldclimate.com> derived from NCDC Cooperative Stations (1911-1995)

The table indicates, there approximately 44,475 gallons of surplus water each year. This water will be directly dumped on the ground through the drainage system. Table 1 assumes that no water will be stored during the winter months.

Recommendations & Maintenance

Pump and Accessories:

1. The pump and pressure switch must be protected from wet weather. Some type of cover is suggested for these items.
2. The water entering the pump should not exceed 90 degrees Fahrenheit and should not drop below 32 degrees Fahrenheit. A roof over the tank may need to be erected to prevent direct sunlight from raising the tank temperature drastically during the summer months.
3. Do not run pump with the manual cistern drain valve open.
4. When draining the tank and pressure lines for winter, the pump must also be drained through the two plugs on pump housing.
5. The pressure switch should turn the pump on at 40 psi and off at 60 psi (use mounted pressure gauge for reference). If it fails to meet these requirements, unscrew the pressure switch cover and adjust the two nuts according to the instructions found on the underside of the switch cover.
6. The pump, pressure switch, and float switch should be hardwired as soon as possible.
7. Periodically check diaphragm tank pre-charge pressure with a standard tire pressure gauge. The pressure should read ~38 psi. If it differs from this value, refer to the owner's manual.

Cistern

1. The tank should be cleaned regularly (skim surface with a fine mesh net to remove debris that may collect). The bottom of the tank may also need to be cleaned periodically. A regular visual inspection through the access port will determine the amount of cleaning that needs to be done.
2. Periodically visually inspect the float switches located on the bottom of the tank near the outlet to make sure they are secured to the cement block. If they are not secured, tie them down in a way that will turn the pump off before the water level reaches the outlet port. This is accomplished by entering the tank after it has been drained. Secure the float cords to the cement block so that the floats will float at the same level. Next hold them both vertical and mimic the action of a falling water level. There will be an audible click at roughly 20 degrees below horizontal. Adjust the height of the floats such that the click is heard before the bottom of the floats reaches the tank outlet port.

PVC Pipe

1. Weekly visually inspect and repair any leaks.
2. The system must be drained during freezing weather. First disconnect the power from the pump and accessories. Unscrew the drain plug located just off of the pad in the pressure line and open the hose line valve. Drain the vertical section of pipe from the pump outlet by draining the pump. The drainage lines will drain themselves.
3. If water in bottom of flume elbow begins to alter water quality, drill small hole in bottom of flume elbow to drain out onto ground

Safety

1. Do not go into tank without supervision and use caution when in tank to avoid drowning
2. Disconnect power supply before servicing system
3. Make sure manual cistern drain valve is closed when system is powered
4. Plug in float switch as indicated in diagram, between electrical supply and pump cord
5. In case of large storm, take ball/spring out of first flush
6. If water begins to collect up the flume, drill more drain holes
7. Do not attempt to raise line pressure above 60 psi. Serious injury could result.

Troubleshooting

No water out of hose

1. Make sure all electronics are plugged in and in correct configuration
2. Make sure manual cistern drain valve is closed
3. Make sure there is water above the float switch

Pump switch clicks on and off

1. Follow direction on underside of cap to adjust pressure switch on/off pressures

Water will not go to tank

1. Make sure first flush device is working properly
2. Close manual cistern drain valve
3. Tank may be full

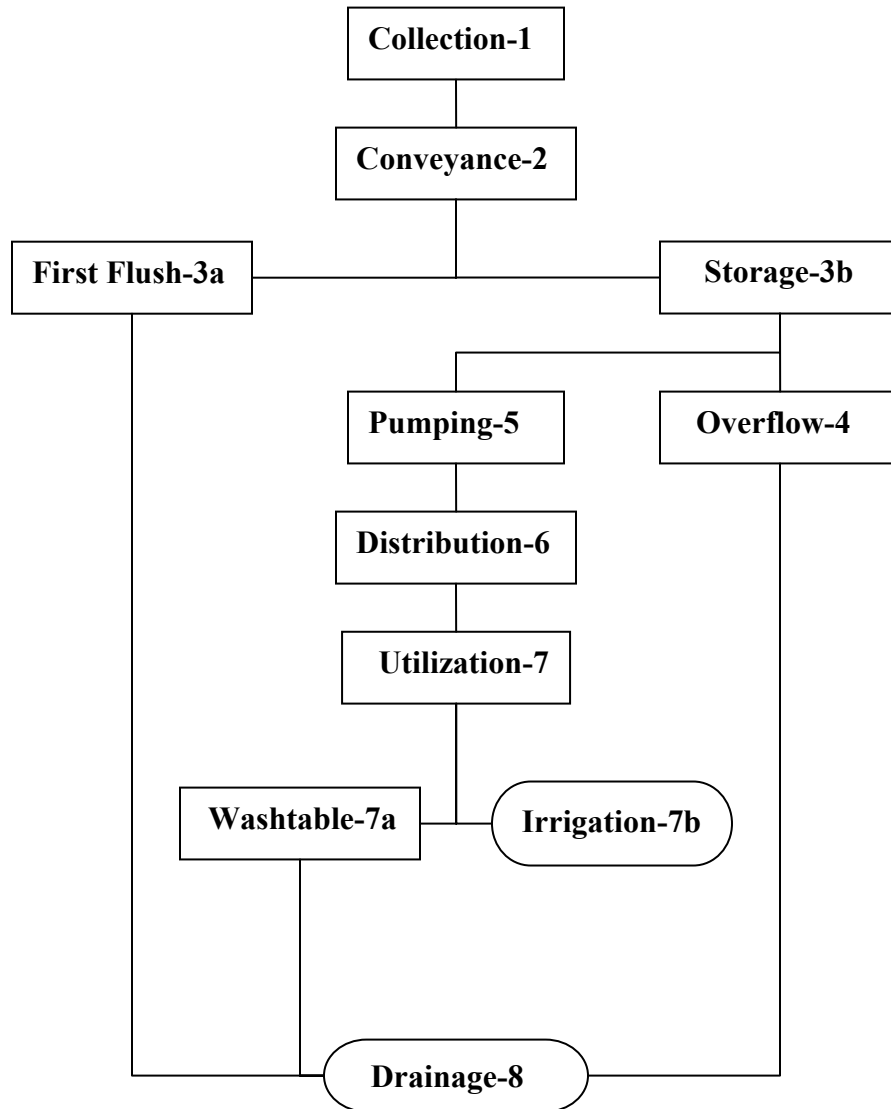
Water is leaking

1. Wait until area is dry and then apply silicon caulk

Drainage Problems

1. Reroute corrugated drain line to new area
2. Trench hard line to nearby creek
3. Check for obstructions in drain line

CFLL Rainwater Harvesting System Flowchart of Water



Related Calculations/Considerations

1-Collection:

How much volume for year will be coming through the system? Distribution throughout the year?

2-Conveyance:

Can Flumes handle volume? Will grate/funnel work? Required fittings? Redo existing flume.

3a-First Flush:

How much flush is appropriate? Setup orientation of First Flush device

3b-Storage:

How big based on needs? Foundation for tank

4-Overflow:

Setup of overflows to drainage

5-Pumping:

Type, capacity, price, specs of pump based on use needs

6-Distribution:

Setup of system after pump, Create possibilities for wash-table and irrigation that will be convenient for installation

7a-Washtable:

Volumetric needs, continuous or on-demand, tie table drain to system drainage

7b-Irrigation:

Vegetation type, rough area, plant needs, get through drought time, possibly xeriscaping

8-Drainage:

Drain to where, what type of drainage can overflow be routed to irrigation for ground dispersal? Must go away from building, tank, and refrigerator