

TIMELY INFORMATION

Agriculture & Natural Resources

Rainwater Harvesting from Rooftops for Non-potable Uses in Alabama Part II - Field Application of RCR system

The Roof Catchment of Rainwater (RCR) system developed at Auburn University was installed at five locations in Alabama, one single family home in Madison county (site 1) and three single family homes (sites 2, 3, and 4) and one school (site 5) in Lee county. Table 1 shows characteristics of the five sites. Due to the shape and location of roof lines only a portion of the total roof area was used to harvest rainwater from each site. Most of the harvested rainwater is used for flushing toilets. But site 3 included a UV disinfection tube so water could also be used for a washing machine. Except for site 2, aboveground centrifugal pumps were used. Since the storage tank at the site 2 is located 15 ft below and 100 ft away from the pump and water flow control unit, a submersible pump was used to compensate the hydraulic head loss. All systems have protection from cold weather by using such practices as heat strips, underground installation, shed, basement, crawl space, etc. However, where portions of a system were still exposed to the atmosphere some owners had to shut down the system when a long period of freezing weather was forecast.

Field photos of the five study sites are shown in Figure 1. The water meters shown were used to monitor water use at the sites. For simple RCR systems no water meters will be needed.

One of the questions often asked in using an RCR relates to the water quality of harvested rainwater. Some misconceptions about the rainwater quality exist, especially as related bacterial (E-coli) and chemical contamination from the atmosphere and roof tops. As shown in Table 2, water quality of harvested rainwater is equal to or better than the treated municipal water or groundwater. Although rainwater from an RCR contains some form of coliforms, no E-coli was detected from the harvested rainwater. The detected common coliforms are not harmful and exist in nature. Mosquitoes and mosquito lava were found in the two tanks that also had high counts of common coliforms (sites 2 and 4). Sodium chlorine tablets were added in the storage tank at the school (site 5) due to infrequent use of the rainwater during the summer break. This treatment raised the concentration level of minerals and acidity.

Another question often asked is whether harvested rainwater adversely affects the supply of water to nearby streams and groundwater. This question can be easily answered by comparing the size of roofed areas vs. other areas within the watershed of the stream. The size of roofed areas is negligible compared to all other areas even in a highly developed urban area and not all roofed structures are feasible to harvest rainwater from the roof top.

Table1. Characteristics of studied RCR systems

	Site Number				
	1 - Rhonda	2- Duncan	3 - Payne	4 - Flynn	5 - School
Roof size to harvest rainwater	725 ft ²	1550 ft ²	1400 ft ²	2000 ft ²	3750 ft ²
Pump	Centrifugal pump (0.5 hp)	Submersible deep well pump (0.5 hp)	Centrifugal pump (0.5 hp)	Centrifugal pump (0.5 hp)	Centrifugal pump (1.0 hp)
Water supply lines	PVC	PVC and Pex	PVC and Pex	PVC	PVC and Pex
Location of flow control system	Crawl space	Crawl space	In a small insulated shed and basement	Crawl space	In a large insulated storage shed
Backup water source	County water	City water	Well water and city water	Well water	City water
Number of residents/users*	4	5	2	4	250
Water uses	Toilet flushing	Toilet flushing	Toilet flushing and washing machine	Toilet flushing	Toilet flushing
Additional insulation	None – system down during cold weather	None – most system is either underground or in the basement	Small shed is insulated but most pipes are underground or in basement.	Heat strip along the pipe and pump	Tanks, pump and most of the pipelines are in a shed and heat strips along the pipes and pump
System layout	Above ground pipelines to pump. Pump and control unit in crawl space	Underground pipelines and other components in crawl space	Underground pipeline to pump. Pump and control unit in small shed. Other components in basement	Above ground pipelines to pump. Pump and control unit in crawl space	Except for short sections of insulated supply pipes. Other components are within a shed or inside the school building
Storage tank	Above ground 750 gallon plastic	Above ground 850-gallon plastic tank	Underground 1200-gallon plastic tank	Above ground 1500-gallon plastic tank	Above ground Two 1750-gallon plastic tanks

* Visitors are not included.

Site Number	Location
1	A single family home in Madison county
2	A single family home in Lee county
3	A single family home in Lee county
4	A single family home in Lee county
5	A medium size school in Lee county

Table 2. Water quality of harvested rainwater at outlets of each facility in July 2009

W/Q parameters	Site Number								
	1 ^{a/}	2	3	4	5	With UV treatment at site 3	City water	Well water at site 3	Well water at site 4
pH		6.28	6.4	6.28	3.6 ^{b/}	6.4	6.53	7.22	6.2
DO, mg/l		3.2	3.4	3.1	5	3.4	2.76	3.63	4.54
Conductivity, μ S		29	25	24	135	25	23	166	73
TDS, mg/l		14	12	12	67	12	12	83	37
Salinity		0.01	0.01	0.01	0.06	0.01	0.01	0.08	0.03
E.Coli per 100 ml		0	0	0	0	0	0	0	0
Other Coliforms per 100 ml		444 ^{c/}	133	588 ^{c/}	88	33	0	0	77

^{a/}No water quality test at site 1

^{b/} Sodium chlorine tablets were added in the tank to control water quality during the school break.

^{c/} Mosquitoes were found in the tank

TDS – total dissolved solid

DO – dissolved oxygen

pH – 7.0 is neutral

Salinity - %. Freshwater has <0.5% and Ocean water has >3.5%

Site 1



Storage tank and roof lines



Pump, pipes, and water flow control in the crawl space

Site 2



Storage tank



Roof lines



Water flow control, pump and pressure tank located in the basement

Site 3



Underground storage tank with buried pipes



Roof lines



Pump and water flow control in an insulated wooden box



UV tube in the basement

Site 4



Storage tank and roof lines



Flow control in the crawl space



Pump and pressure tank located in the crawl space

Site 5



Storage tanks and roof lines before an insulated shed was built to house the RCR



Pump and pressure tank



Water flow control

Figure 1. Field photos of the Rainwater harvesting study sites.