A Self-Funding Stormwater Utility:

Complimenting the Centralized Water System with a

Rain Harvesting Stormwater Utility

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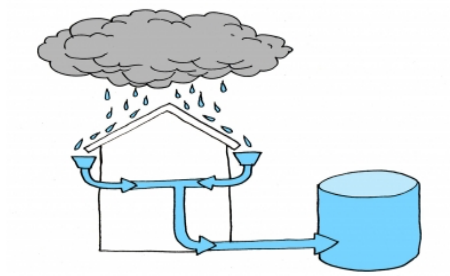
INTRODUCTION

This proposal will explain how using rainwater harvesting as a Best Management Practice (BMP) to reduce flows during rain events and use the water for non-potable needs. Water captured from storm events can be sold to customers needing non-potable water through the leasing of tanks and access to water from larger tanks.



The idea of a decentralized system came to me in stages after I realized the potential that rainwater harvesting could bring to our area. I witnessed landscaping trucks watering plants, people washing sidewalks and urban gardens trying to supplement irrigation with rain barrels. All were using potable water. If rainwater harvesting systems (RHS) were placed through out a city to supply clean non-potable water, much of our water could be supplied directly from the rain. The problem of implementing RHS on a large scale in the private sector is a large upfront cost and lack of short-term payback on the investment. Many irrigation RHS will take will have a payback of 10 years or more due to seasonal use and the erratic climate patterns; however, once installed, cost and maintenance are minimal. A RHS should have a life cycle of 20-30 years or more giving a positive return on 10 years or more to payback, because they have seasonal use and the erratic climate patterns we investment. If the utilities had a revenue source from rain harvesting they would embrace the practice. Through my investigation in this project, the lower energy requirements discovered and stormwater management benefits in RHS are the key to making them economical. This led me to realize that this concept could be used as a self funded stormwater utility that provides a product (water) for a fee to pay for the utility cost.

I live in Atlanta where rainfall has been historically plentiful with an average 50 inches of rain per year falling on the city. Rain harvesting allows the capture of 0.625 gallons of water per square foot of roof per 1 inch of rain. In reality just over 0.5 gallons of water per square foot is captured. Rain harvesting loses approximately 15-20% during catchment depending on the roof design and weather conditions. A 10,000 square foot building can produce as much as 275,000 gallons of water per year in Atlanta.

Another factor is the quality of water. Rainwater contains virtually no minerals or chemicals. When captured properly the water is of potable quality in the tank. Domestic water from the utility contains chlorine, fluoride and wide range of minerals, chemicals and possibly prescription drugs. Water with minerals and chemicals retards plants growth sometimes as much as 20-30 percent and require more water to quench the plant's thirst. Well water also retards plants growth and diminishes the quality of the soil over time. For more information download Irrigation Water Quality for Agriculture from the UGA Extension Service.

This plan will explain how water authorities in moderate to wet climates can use rainwater to supply their non-potable water needs, generate revenues from the sale of this water and provide a stormwater utility that funds itself.

EXECUTIVE SUMMARY

This plan is to develop a decentralized water system within an authority for non-potable uses such as irrigation, urban farms, parks, washing needs, water features, utility trucks and any other non-potable needs. The authority can install and maintain the tanks allowing a revenue stream to offset the potable water loss. The rainwater harvesting systems can be leased at a monthly fee based on

the cost of the system or be hooked up to violet hydrants to allow vehicles fill their tanks and provide revenue. The fees will be based on the cost of water using current rates. A self-funding stormwater utility is created.

Water use for this project falls into two categories listed below:

- Non-Potable Water Use: This includes a better quality of water used, stored and sold for irrigation, water features, port-a-potties, street sweepers and utility trucks.
- Stormwater Management – Managing the quantity and quality of stormwater. The stormwater that runs off roofs will be directed to tanks for use and during the off season can be released slowly over time to minimize flooding. This will help keep contaminants out streams as well as reduce flooding and erosion.

THE PLAN

Components of the Plan Include:

- Tanks will be set up in parks and at private businesses to supply water for irrigation and other needs and be charged a flat fee based on cost of the system and current water rates.
- An emergency water reserve will be available through out the city.
- Stormwater management reducing flooding and stream pollution.
- New source of revenue for authorities.
- Stormwater management reducing CSO's

Payment would be charged monthly as a flat fee or the same as traditional rates if large tanks were erected with hydrant access. This would allow the customer to budget water costs and offer the authority a simple payment system eliminating the cost of meter installation, maintenance and reading of meters. Using tanks as a finite source of water will help educate customers to the value of water and how much they use.

SITE

Sites will vary. Above ground tanks are the easiest to set up and remove allowing versatility. There can also be Public/Private Partnerships created to allow private buildings to allow placement of tanks on private land. Stormwater credits or non-profit donations to the system can compliment the use. One example is the New Atlanta Falcons Stadium support of a 7300 gallon rainwater system for Trees Atlanta.

COSTS AND RATES

From my calculations a water rate of $5 - $7.50 per 748 gallons (CCF) or $6.67 - $10 per 1000 gallons for the tier rate is needed. A stormwater utility would also help to make this system economically feasible.

Water use is based on maximum use of the tank. Tanks are sized according to no water availability for 4-5 weeks. Water use for irrigation is erratic, because of climate. However, when needed water becomes invaluable. Stormwater management benefits cannot be calculated because stormwater utilities vary.

ENERGY

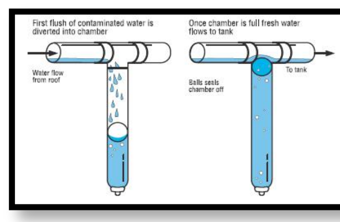
The key component to RHS that may be overlooked is the energy savings. Satisfying the Nation's water needs requires energy for distribution and treatment of water. Electricity costs represents approximately 75 percent of the cost of municipal water processing and distribution (Powicki, 2002) according to the ENERGY DEMANDS ON WATER RESOURCES by the US Department of Energy.[1]

Energy reduction is a known benefit in water efficiency, but there is little public discussion about the how much energy is used related to water treatment. As mentioned above a key component of this plan is energy savings. The cost of treatment for RHS will only include maintenance of the filters, maintenance of the tanks and the cost of electricity for pumping water with a small pump to transfer the water onsite. No energy is required to treat the water collected, because gravity is used to clean the water as it piped into the tank from the roof as described below in the rainwater filtration section. Not only will this system reduce potable water use, but will save a great deal of energy.

RAINWATER FILTRATION

Rainwater is very clean before and after it lands on the roof if collected properly. To provide clean rainwater the surface of the roof must be cleaned. This is accomplished by filtering the water first through a roof washer (fine stainless steel screen) placed at the bottom of downspouts to remove the particulates.

The next step is to divert the first 2-5% of the water on the roof to a first flush device. This device will divert the roof contaminants in the water from the tank. When the pipes are filled the device closes and clean water will go into the tanks. The contaminants drain from the first flush device slowly back into the ground through gravity.



The water enters the tank through a calming inlet so not to stir any sediment settled on the bottom of the tank. The water is filtered through another fine stainless steel screen attached to a floating filter when pumped out of the tank. The filter collects the water 6-8 inches below the surface. This is the cleanest and most oxygenated water. If this simple design is followed the water in the tanks should be potable. No other filtration is needed. The system also prevents mosquitos from leaving the tank through piping and screens.

TANKS

Tanks used will be either 2500 gallon above ground models and made from FDA approved UV stabilized polyethylene and plastic liner tanks. Smaller tanks were priced, but the return was unfavorable. These tanks are usually green, but

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[1] ENERGY DEMANDS ON WATER RESOURCES - REPORT TO CONGRESS ON THE INTERDEPENDENCY OF ENERGY AND WATER Chapter III conducted by the U.S. Department of Energy - 12/2006

are available in a variety colors. To increase capacity 2500 gallon tanks can be linked together.

For storage needs larger than 10,000 gallons or more plastic liner tanks can be used to store up to 800 thousand gallons and are built on site. Tanks can be placed on the ground supported by pavers or gravel for easy installation and removal. These tanks come in corrugated or an industrial style.

EVAPORATION

The efficiency of storage is something not mentioned when designing reservoirs or comparing rain harvesting to reservoirs. Evaporation from Lake Lanier is about 40 inches per year with an annual average precipitation of 54.8 inches, which calculates to a 73% loss of water according to a US Department of Commerce Technical Paper.[2]

Another story related to water storage more efficiently in tanks then in traditional reservoirs, because of evaporation in an AJC article Sun Drains .2 Inch of Water Daily from Lanier by Satavy Shelton Published on 06/19/08

> *193.9 million gallons of water evaporated from the lake, the main water source for more than 3 million in metro Atlanta. By comparison, Gwinnett County withdrew an average of 74.2 million gallons a day from the lake in May, or less than half the amount that's disappearing in the sun's rays.*

The results of an evaporation test I designed over 3 years compared an open bowl of water (reservoir) to a bottle of water (cistern) with a loose cap over the last 2 years and as the third year test shows an open bottle. The green bottle simulates a rainwater cistern, which has only a venting system connecting it to the environment. The green bottled contained 32oz of water and lost 1-2oz each year over a 2 year time period and 5 oz. for the third year with the cap removed.

AESTHETICS

There has been some resistance to above ground rainwater tanks due to aesthetic concerns, which have often been perceived as unattractive or eyesores. More options are available now, with some manufacturers offering as many as 13 different colors and incorporating a black layer to completely remove light from entering the tanks. There is always the choice to ~~put in~~ place the tanks on a side of the building that is not viewed or hidden behind a fence or landscaping.

MAINTENANCE

Quarterly maintenance is usually sufficient. Maintenance consists of cleaning the roof washer screen, the first flush filter and gutters. Each site is different and will have to be monitored. If functioning properly the tanks should remain working/clean for years. Maintenance can be performed by the client, but should be inspected by local authority.

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[2] US Department of Commerce Technical Paper NO. 37, M. A. Kohler, T. J. Nordenson and D. R. Baker Hydrological Service Division, 1959 Evapotranspiration and Droughts by Ronald L. Hanson, U. S. Geological Survey 1991

IN CONCLUSION

This concept will help rainwater harvesting become more accessible to the public and provide them with the quality of water they want with out the large upfront investment necessary to implement rainwater harvesting. As the practice grows others can see the benefits and realize the long-term investment is economically feasible. Information on energy use and evaporation were shared to show how much more efficient and sustainable rainwater harvesting can be when compared to traditional water reservoirs. The system will complement the centralized system and be a profitable revenue stream for the city. The concept is to provide a higher quality water source for non-potable use, which can be priced competitively with domestic water. In fact, this has the potential to be a self-sustaining stormwater utility.

By managing rainwater and stormwater efficiently would insure plenty of water for generations. Expanding the reservoir system with the cost of land, new infrastructure, energy use, environmental issues and the loss due to evaporation seems futile. A decentralized system can be implemented within several years instead of the decades it takes to complete a reservoir. With drought conditions forecast for Georgia in the near future, now is the time to consider implementing this plan.