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IBM Innovation to be Greener

Fighting the Drought

Problem: Since July 2007, the state of Georgia has fallen into a serious drought condition¹. From October 2007 to January 2008, the number of areas in the Southeast that had D-4 exceptional drought conditions increased². Also, by October 2007, sixty-one counties in Georgia had a drought level of 4 while the rest of Georgia had a drought level of 2. In response, Governor Sunny Perdue ordered all sixty-one counties to reduce their water usage by ten percent from last winter's records³. In addition, all outdoor water usage was banned⁴. Fortunately, as the spring of 2008 approached, northern Georgia experienced sporadic thunderstorms and the seriousness of the drought was somewhat alleviated⁵. Northern Georgia's drought level dropped to 2 and the 61 counties are now allowed to water lawns on three days every week for 25 minutes per day and pools are allowed to operate beginning in April 2008³. However, Lake Lanier, a reservoir in northern Georgia, is still 362 billion gallons of water short of its normal level during the summer⁶. Due to the scarcity of water, citizens of Georgia are encouraged to conserve water by stopping water usage for beautification purposes, recycling water in pools, taking shorter

¹ Blackwood, Harris. "Georgia Moves from Exceptional to Extreme Drought." Gainesville Times. 19 April 2008 <<http://www.gainesvilletimes.com/news/archive/4444>>.

² "U.S. Drought Monitor Southeast." 19 April 2008 <http://www.drought.unl.edu/dm/DM_southeast.htm>.

³ "Cobb County Drought Response Plan Spring and Summer 2008." Cobb County Government. 19 April 2008 <<http://www.cobbcountyga.gov/drought-information.htm>>.

⁴ "Georgia Drought." University of Georgia. 19 April 2008 <<http://www.caes.uga.edu/topics/disasters/drought>>.

⁵ "Lea Fite: Though the Drought is Getting Better, We Still Need a Water Plan." Jacksonville News. 19 April 2008 <<http://www.jaxnews.com/opinion/2008/jn-opcolumn-0312-0-8c12n2442.htm>>.

⁶ "We've Improved to 'Extreme Drought' Status." Atlanta Water Shortage. 19 April 2008 <<http://www.atlantawatershortage.com/20080326/weve-improved-to-extreme-drought-status>>.

showers, etc³. Although the seriousness of the drought came as a surprise to many residents, according to Sabrina Pemberton-Piper, Communications and Public Education Manager for the Cobb County Water System, the drought in Georgia is not the first and will not be the last⁷. Because Georgia's weather is such that water is a precious resource, the only way to lessen the effect of droughts is by conservation.

Parameter: During the worst period of the drought, sixty-one counties in north Georgia experienced a D-4 drought level while the other ninety-eight counties experienced a D-2 drought level. Other areas of the U.S. that continue to be affected by this abnormally dry condition include southern Texas, the rest of the Southeast, and the High Plains. The drought in the Southeast, in particular, is caused by the "La Nina weather pattern," a pattern of dry and warm weather⁷ that regularly affects the area. In both the Southeast and the High Plains, the drought caused limitations on water usage while the drought in southern Texas caused agricultural damage⁸.

Impact: Both private enterprises and residents were and continue to be affected by the drought. In the Chestnut Springs neighborhood in Marietta, Georgia, many lawns continue to have patches of dying grass that are yellow, in comparison to the usual healthy green color, even after a few months into the spring. The use of the community pool and the activities of the swim team were suspended until April 2008. Before pool usage was allowed again, the Chestnut Springs neighborhood petitioned to the county government concerning the use of pools. Residents in the drought areas are not allowed to operate aesthetic systems such as fountains that waste water, even if the water is recycled³. Currently, car dealerships are not allowed to wash cars unless they use a system that recycles water. Many private businesses that involve "landscaping, irrigation,

⁷ Pemberton-Piper, Sabrina. "FW: Concerning the Drought." Email to author. 16 April 2008.

⁸ "U.S. Drought Monitor." 19 April 2008 <<http://www.drought.unl.edu/DM/monitor.html>>.

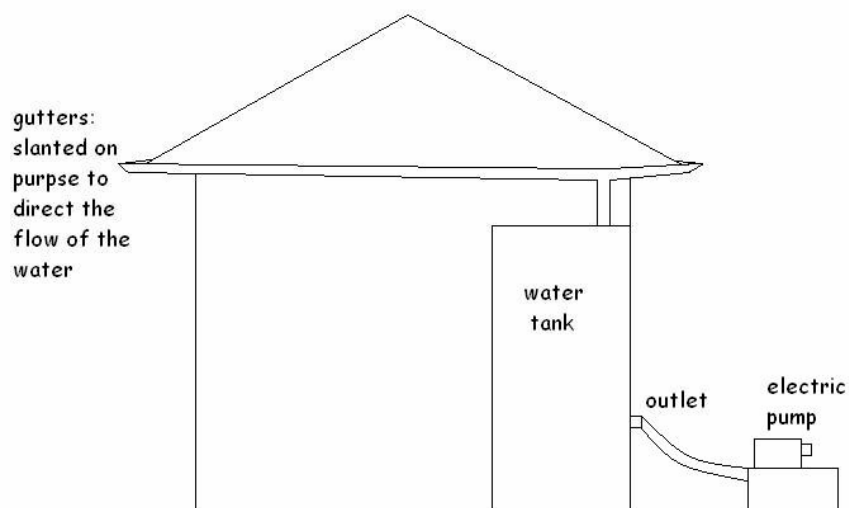
nurseries, [and] pressure washers” have had to close down, causing many job losses⁷. To ensure the water rides have enough water to operate for the summer, the Six Flags in Atlanta is currently drilling wells next to its waters rides⁹. In reaction to the impact of the drought, residents have expressed different opinions toward the restrictions imposed by the state as well as the county. Some people trust the government and its policies while others are dissatisfied with the government’s actions⁷.

Solution: Because drought is not curable, the solution is the conservation of water in drought areas. Also, because urbanization creates “impervious surfaces” such as “rooftops [and] driveways,” these changes to the face of the earth can directly impact the weather in urbanizing areas⁷. Therefore, the pattern of drought cannot be completely eradicated unless major cities are deconstructed. However, the seriousness of the drought conditions can be lessened by increasing the area that is harvesting rain. By building systems that harvest rain on the roof of residential houses, the amount of rain water that is conserved for future use can be greatly increased. This plan can be carried out by building gutters surrounding the eaves of the roof. As the rain trickles down from the roof to the gutters, it passes through a fine net that prevents any waste from clogging the drain. As the water is collected, it drains into a tank in which the water is stored for use. The water is distributed using an electric pump to facilitate usage. The water harvested can be used for outdoor activities such as washing the car or watering gardens and the lawn. According to the calculations, the volume of water harvested per year on a regular house rooftop can supply approximately 24,510 gallons water per year and can save about \$60.54 dollars per year for each house. This is an inexpensive way residents in drought areas can help alleviate the serious impact of the scarcity of water on the community.

⁹ Opdyke, Tom. “Six Flags to Drill Two Wells for Its Water Attractions.” Atlanta Journal Constitution. 19 April 2008 <http://www.ajc.com/metro/content/metro/cobb/stories/2008/03/28/water_0329.html>.

Implementation: The implementation of this rain harvest design is not very difficult. If the gutters are added to a house that did not originally have gutters, the cost is approximately \$360 to \$600 for vinyl gutters¹⁰. However, most houses do have gutters already and the only step that needs to be done is directing the gutter into a tank. The tank may cost about \$200¹¹ and the electric pump used to distribute the water is about \$75¹⁰. The net used to cover the gutter can be bought in craft stores for about \$0.14 per square meter¹². The labor needed to build the design is minimal because the job can be done without a professional.

Blueprint:



* May change according to the roof structure of the house.

Calculations:

Average rainfall in Georgia in 2007¹³: 31.85 inch = 0.80899 m

Average area of a house¹⁴: $2469 \text{ ft}^2 = 229.377606 \text{ m}^2$

¹⁰ Winslow, Lance. "Aircraft Hanger Rain Water Collection to Wash Aircraft – Cost to Collect Water." Ezine Articles. 19 April 2008 <<http://ezinearticles.com/?Aircraft-Hanger-Rain-Water-Collection-to-Wash-Aircraft---Cost-to-Collect-Water&id=526973>>.

¹¹ "Cost of Water Tanks." 19 April 2008 <<http://www.watertanks.com/category/6>>.

¹² Spandex House, Inc. 19 April 2008 <<http://www.spandexhouse.com/products.asp?id=89&pname=Big%20Hole%20Fishnet>>.

¹³ Stanford, Ken. "Lanier up 6 Inches; More Rain in Dec. in Gainesville than Any Month since July." 19 April 2008 <<http://www.accessnorthga.com/detail.php?n=205310&c=1>>.

Assuming the house has two floors: $229.377606 \text{ m}^2 / 2 = 114.688803 \text{ m}^2$

* Note that the area of the house is used, not the area of the roof because the slant of the roof adds more to the area of rain water collection than is actually used.

Approximate volume of water collected:

$0.80899 \text{ m/year} \times 114.688803 \text{ m}^2 = 92.78209473897 \text{ m}^3/\text{year} = 24510.4364 \text{ gallons/year}$

Cost of the water: $\$2.47 \text{ dollars/1000 gallon} \times 24510.4364 \text{ gallons/year} = \$60.54 \text{ dollars/year}$

* Cost of water from Cobb County Water System bill.

Conclusion: The proposed rain water harvest system allows residents to water their lawns, gardens, and cars even during an extremely serious drought because the water collected cannot be used for any other purposes otherwise. If one house can save 24,510 gallons of water per year, then in a neighborhood of three hundred houses such as Chestnut Springs, 7,353,000 gallons of water can be saved per year. In addition to conserving water, the design also saves money that would otherwise be spent on paying for the water from the government water systems. This, in turn, will save the government money that is spent on processing the water to make it drinkable. By using this system to conserve water, droughts will have less impact on the community and people whose jobs involve the usage of water will less likely lose their jobs because of natural phenomenon that no one can control. Although rain harvesting seems to be a feasible option in lessening the effect of droughts, ultimately, droughts are a part of a phenomenon, the Greenhouse Effect, that requires special attention for all the generations to come.

¹⁴ “Average Area of House in U.S.” 19 April 2008 <<http://www.census.gov/const/C25Ann/sfttotalmedavgsqft.pdf>>.

Works Cited

“Average Area of House in U.S.” 19 April 2008

<<http://www.census.gov/const/C25Ann/sfttotalmedavgsqft.pdf>>.

Blackwood, Harris. “Georgia Moves from Exceptional to Extreme Drought.” *Gainesville Times*.

19 April 2008 <<http://www.gainesvilletimes.com/news/archive/4444>>.

“Cobb County Drought Response Plan Spring and Summer 2008.” Cobb County Government.

19 April 2008 <<http://www.cobbcountyga.gov/drought-information.htm>>.

“Cost of Water Tanks.” 19 April 2008 <<http://www.watertanks.com/category/6>>.

“Georgia Drought.” University of Georgia. 19 April 2008

<<http://www.caes.uga.edu/topics/disasters/drought>>.

Opdyke, Tom. “Six Flags to Drill Two Wells for Its Water Attractions.” *Atlanta Journal*

Constitution. 19 April 2008

<http://www.ajc.com/metro/content/metro/cobb/stories/2008/03/28/water_0329.html>.

Pemberton-Piper, Sabrina. “FW: Concerning the Drought.” Email to author. 16 April 2008.

Spandex House, Inc. 19 April 2008

<<http://www.spandexhouse.com/products.asp?id=89&pname=Big%20Hole%20Fishnet>>.

Stanford, Ken. “Lanier up 6 Inches; More Rain in Dec. in Gainesville than Any Month since

July.” 19 April 2008 <<http://www.accessnorthga.com/detail.php?n=205310&c=1>>.

“The Nutshell September/October 2007.” 19 April 2008

<<http://www.chestnutsprings.org/nutshell/sep07.pdf>>.

“U.S. Drought Monitor.” 19 April 2008 <<http://www.drought.unl.edu/DM/monitor.html>>.

“U.S. Drought Monitor Southeast.” 19 April 2008

<http://www.drought.unl.edu/dm/DM_southeast.htm>.

“We’ve Improved to ‘Extreme Drought’ Status.” Atlanta Water Shortage. 19 April 2008

<<http://www.atlantawatershortage.com/20080326/weve-improved-to-extreme-drought-status>>.

Winslow, Lance. “Aircraft Hanger Rain Water Collection to Wash Aircraft – Cost to Collect

Water.” Ezine Articles. 19 April 2008 <<http://ezinearticles.com/?Aircraft-Hanger-Rain-Water-Collection-to-Wash-Aircraft---Cost-to-Collect-Water&id=526973>>.