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EFFECTS OF VARIOUS FACTORS ON THE SIZING OF RAIN WATER CISTERN SYSTEMS

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INTRODUCTION

The use of cisterns has been recorded as far back as 2,000 B.C. in the Middle East. Cisterns were also used in ancient Turkey. The Maya Indians in Mexico used cisterns as early as 300 A.D., and these cisterns played a major role in the development of the Mayan culture. Today in the U.S. Virgin Islands, cisterns serve as the principal source of water for over 75% of the residents.

PURPOSE OF THE STUDY

Just how large should a cistern be in order to store enough water when it rains to meet our needs when it doesn't rain? How is this best size determined? What factor should we take into consideration in determining the optimum size of a cistern? What are some of the ways to insure that the water in our cistern is of the highest quality? These are some of the questions answered in this study.

QUALITY CONSIDERATIONS

We are all concerned about the quality of the water in our cisterns. The water can be contaminated from several sources. Between rains, insects, birds and rodents may visit our roofs and leave deposits. Trees overhanging our roofs may also be a source of contamination. The roofing material itself or the cistern walls may interact with the water and cause contamination.

One means of improving the quality of water before it enters the cistern is by preventing the first five to ten minutes of rain water from going into the cistern. The water from the first few mintues of rain (foul flush) contains much of the pollutants that were on the roof. Chlorination is another way to improve the quality of cistern stored water.

QUANTITY CONSIDERATIONS

To arrive at the best design for your cistern, five factors should be considered:

1. The amount and distribution of the rainfall available for use
2. The amount and characteristics of the catchment area
3. The water demand
4. Economics
5. Storage capacity

The cistern designer has control over neither the amount and distribution of the rain nor the amount of water we use. Quite often the designer also has no significant control over the size of the catchment area. And naturally, the bigger the cistern the greater the cost of construction. What the designer does have control over is determining the best size for a cistern when all the other factors are considered.

COMPUTER PROGRAM AIDS CISTERN DESIGNERS

As part of the study, a computer program was developed using an Apple II micro-computer to aid designers in determining the best size for a cistern. Given a certain amount of rainfall over a period of time, the program combines this with information about the average amount of water used on a weekly basis (demand), and the size of the catchment area (roof). Once this information is put into the program, it can tell us just what percent of the time a cistern of a certain size will meet our demand.

The program answers such questions as: If I use a certain amount of water each week how big should my cistern be in order to supply my needs a specified percentage of time? If I use so much water each week and my cistern is of a certain capacity, what percent of the time will my cistern supply my needs?

For 21 years of weekly rainfall data from Sprat Hole, St. Croix, U.S. Virgin Islands having the weekly averages shown in Figure 1, cistern sizing curves were developed using the computer program. Curves such as this aid the designer in determining the size cistern that would have to be provided to satisfy various levels of reliability and demand. For example, from the sizing curves in Figure 2, it could be determined that for each square foot of roof area it would be necessary to provide 7.0 gallons of cistern storage to satisfy a weekly demand of 850 gallons at a reliability level of 75%.

Condensed by Yahaya Bello from: "Effects of Various Factors on the Sizing of Rain Water Cistern Systems" by Henry H. Smith, Technical Report No. 19, Water Resources Research Center, Caribbean Research Institute, St. Thomas, September 1984

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FIGURE 1. 21-Year Weekly Rainfall Averages at Sprat Hole, St. Croix, U.S.V.I.

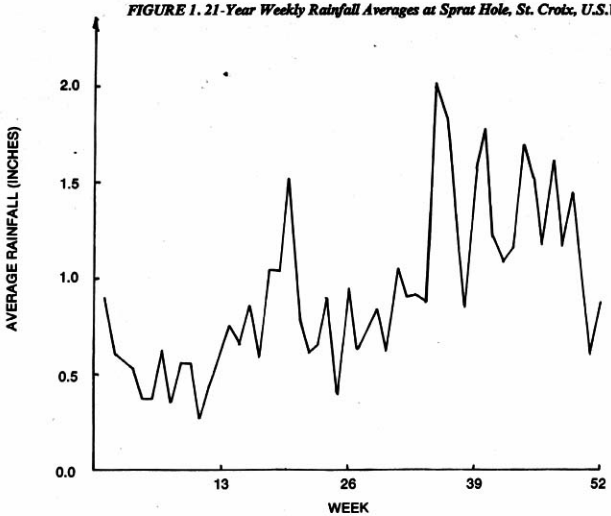

FIGURE 2. Cistern Sizing Curves for Sprat Hole, St. Croix for Several Deman Levels With A Catchment Efficiency of 85%