

DESIGNING YOUR RAINWATER CATCHMENT AND STORAGE SYSTEM

**FOR RAINWATER CATCHMENT
SYSTEMS IN POHNPEI STATE FSM**

By

Leroy F. Heitz



WERI

**WATER AND ENVIRONMENTAL RESEARCH INSTITUTE
OF THE WESTERN PACIFIC
UNIVERSITY OF GUAM**

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**These guidelines may only be used for:
Pohnpei Island, and Ant, Ngetik, Mwokil and Pingelap Atolls in
Pohnpei State, FSM**

HOW BIG SHOULD A NEW TANK BE? IS YOUR OLD TANK BIG ENOUGH?

This booklet provides answers to **THREE QUESTIONS**:

- How **BIG** should you make a **NEW** rainwater storage tank?
- Is your **OLD** rainwater storage tank **BIG** enough?
- What should the water in your storage tank be **USED FOR**?

In the home, the **SIX MAIN USES OF WATER** are:

- Drinking
- Cooking
- Washing dishes
- Bathing
- Washing clothes
- Flushing toilets

Here are some **RULES**:

- **ALWAYS** use the water in your rainwater storage tank for drinking, cooking, and washing dishes.
- **SOMETIMES** use the water in your rainwater storage tank for bathing and washing clothes.
- **NEVER** use the water in your rainwater storage tank for flushing a toilet.

So, we have almost answered the question "What should the water in your rainwater storage tank be used for?" We only have to find out **WHEN** it should or should not be used for bathing and washing clothes. This booklet will give you the answer to this question.

BASIC ASSUMPTIONS

All of the information given in this booklet is based on some **ASSUMPTIONS**. They are:

- Your home uses around 4 **GALLONS** of water per person per day for drinking, cooking, and washing dishes.
- Your home uses around 11 **GALLONS** of water per person per day for bathing and washing clothes.

If you use less than this, the tank sizes given in this booklet may be larger than necessary. If you use more than this, they may be too small.

The information provided in this booklet is applicable to Pohnpei Island and Ant, Ngetik, Mwokil and Pingelap Atolls. The design criteria provided is based on rainfall at the Pohnpei Island US Weather Service Gage. It is recognized that there are some differences between the rainfall at the Pohnpei gage and the rainfall on the atolls listed. It has been determined that the difference is small enough to be insignificant for the uses made in this booklet.

If you live somewhere other than the areas specified above, you should not depend on the charts provided in this booklet.

Since you can not use your rainwater storage tank for bathing and washing clothes all the time, it is important to have access to another dependable source of water. A well or stream is the most common source. If you do not have access to such a source, you will be tempted to use your tank for purposes other than those that are recommended in this booklet. If you do

this, **YOUR TANK MAY BECOME EMPTY.**

CHARTS FOR TANK SIZING

The charts in the back of this booklet are based on COMMON FERROCEMENT TANK SIZES. All are 6 feet high. Their diameters depend on the number of pieces of standard reinforcing rod (rebar) that is used to go around their circumference. Here is a summary of the important information about these tanks:

| Number of rebars | Diameter (feet) | Gallons |
|------------------|-----------------|---------|
| 1 | 6.4 | 1,400 |
| 1.5 | 9.4 | 3,100 |
| 2 | 12.7 | 5,700 |

The charts also refer to a 500-gallon tank. This is a popular size of fiberglass or plastic tank.

If you feel that the information given in this booklet does not answer questions you have concerning the design of your rainwater catchment and storage system, please contact the Water and Environmental Research Institute (**WERI**) for further information. The mailing and e-mail addresses and telephone and fax numbers for WERI are provided at the end of this booklet.

SIZING NEW TANKS

Here are the STEPS to use if you want to know how BIG to make a NEW tank:

*STEP 1. Measure the **LENGTH** and **WIDTH** of your roof.*

*STEP 2. Find your **ROOF SIZE**.*

*Multiply Length times Width.
Roof Size = Length x Width*

*STEP 3. Select a **ROOF FACTOR**.*

*If the entire roof has gutters, use **1.0**
If 3/4 of the roof has gutters, use **0.75**
If 1/2 of the roof has gutters, use **0.50**
If 1/4 of the roof has gutters, use **0.25***

*STEP 4. Select a **GUTTER FACTOR**.*

*If your gutter has only a few leaks, use **0.90**
If your gutter has a number of leaks, use **0.75**
If your gutter has a lot of leaks, use **0.60***

*STEP 5. Find your **USEABLE ROOF SIZE**.*

Multiply Roof Size times Roof Factor times Gutter Factor.

Usable Roof Size = Roof Size x Roof Factor x Gutter Factor

*STEP 6. Write down the **NUMBER OF PEOPLE** that live in your home.*

*STEP 7. Use the **CHARTS** at the back of this booklet to get the size of your **NEW** tank.*

EXAMPLE ONE

Your roof is 34 feet in length by 25 feet wide. There are gutters around 3/4 of your roof and they have very few leaks. There are 5 people in your family. How BIG should your NEW tank be? By following the steps on the previous page, we can fill in the blank spaces below.

Step 1. Length 34 feet
Width 25 feet

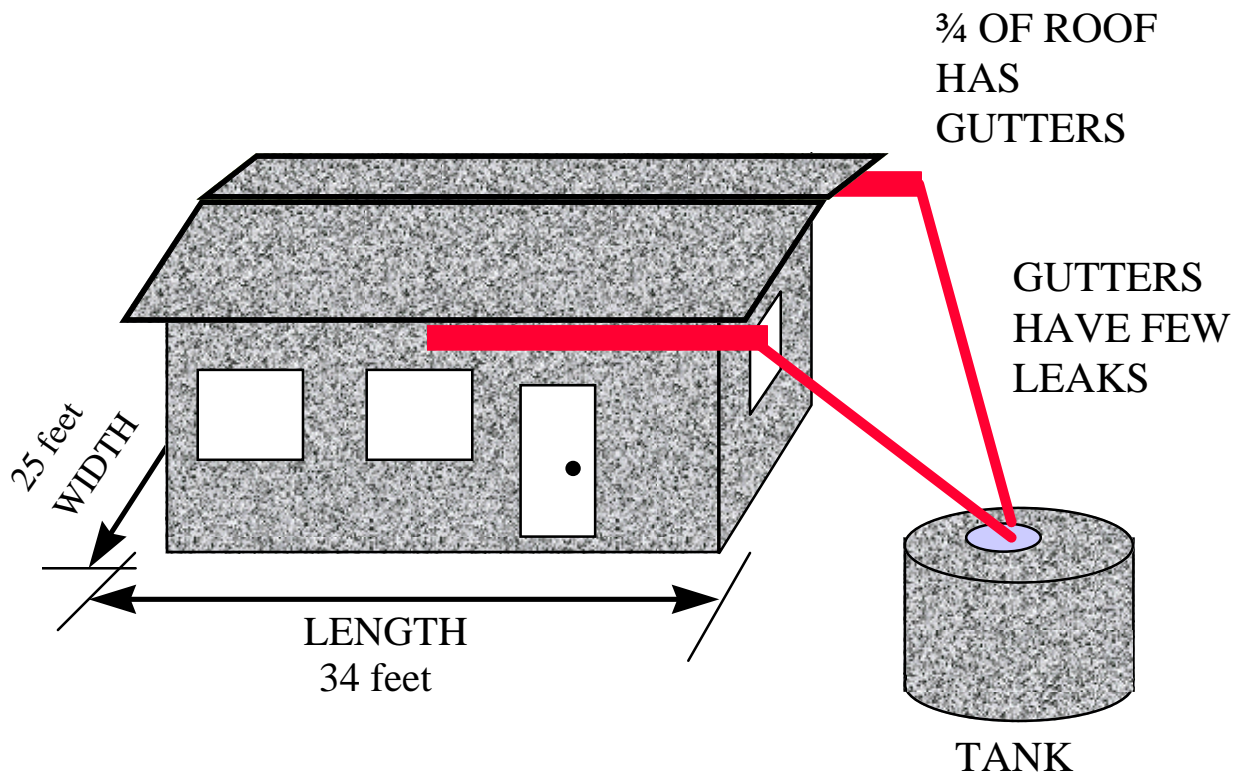
Step 2. $\frac{34}{\text{Length}} \times \frac{25}{\text{Width}} = \frac{850}{\text{Roof Size}}$ square feet

Step 3. Roof Factor = 0.75

Step 4. Gutter Factor = 0.90

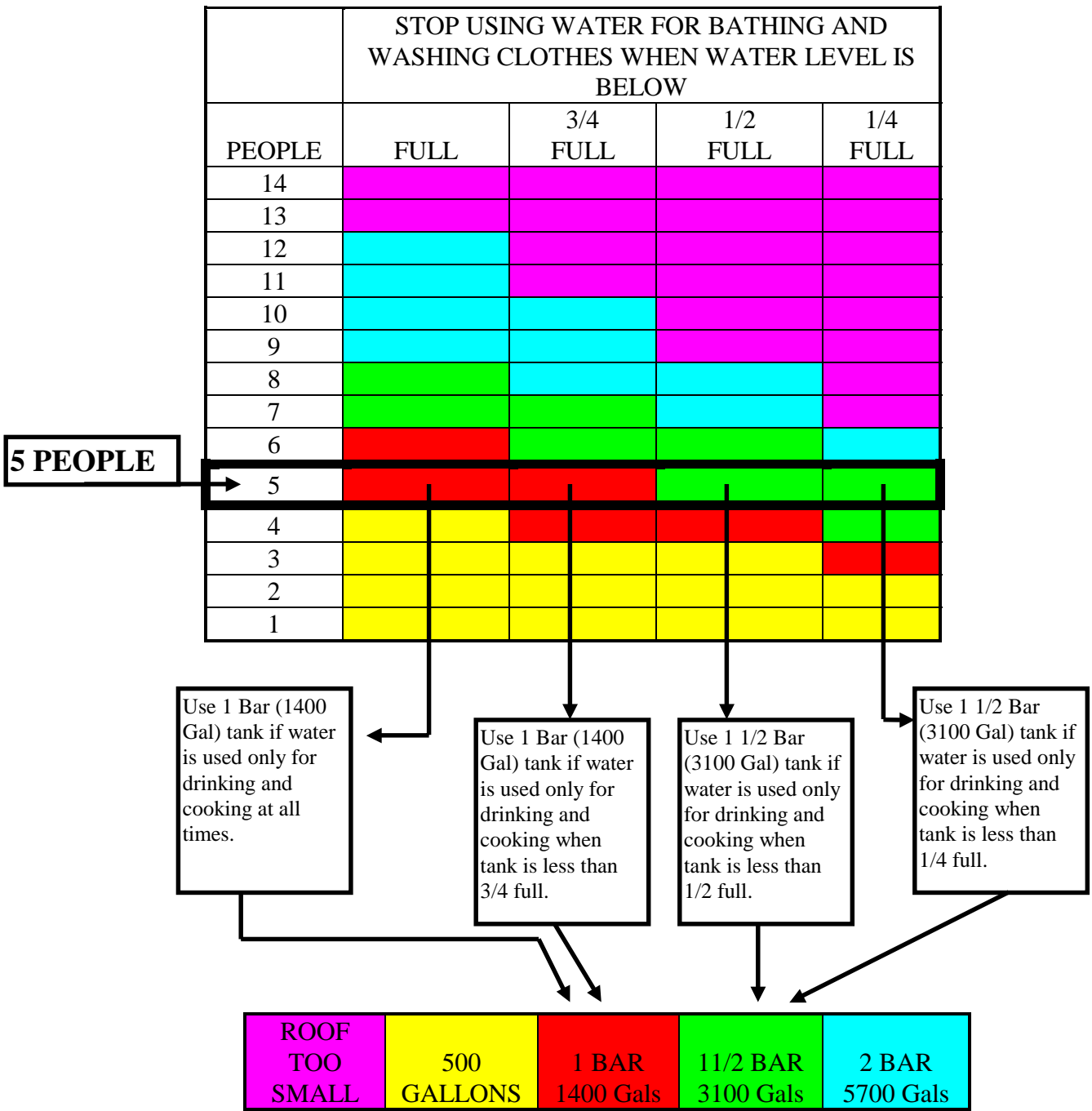
Step 5. $\frac{850}{\text{Roof Size}} \times \frac{0.75}{\text{Roof Factor}} \times \frac{0.90}{\text{Gutter Factor}} = \frac{574}{\text{Useable Roof Size}}$ square feet

Step 6. 5 people



Step 7. Go to the chart for your useable roof size. Since your roof size is **574** square feet, you should use the chart labeled "For useable roof size of 400 to 600 square feet" which is on page 12. The same chart is shown below for easy reference. Locate the row labeled 5 people in the left-hand column.

**FOR USABLE ROOF SIZE
OF 400 TO 600 SQUARE FEET**



Step 7.(cont) There are FOUR answers to the question of how BIG your NEW tank should be. First look again at the graph on the previous page. You will see that these answers are represented by four colored boxes to the right of the box that shows the number of people. These colored boxes tell us what size tank you need depending on WHEN you stop using the water in your tank for bathing and washing dishes. For example:

- If you stop using your tank for bathing and washing clothes when the tank level decreases below 1/4 full, you should look in the last column to the right that is labeled 1/4 full. Notice this column contains a (green box) in the five people row. This corresponds to a 1 1/2 Bar tank which has a capacity of approximately 3,100 gallon.
- If you stop using your tank for bathing and washing clothes when the tank level is below 1/2 full, the tank size recommended in the 1/2 full column is a 3,100 gallon tank (green box). Note this is the same size tank as required if you begin using water at a lower rate when the tank is 1/4 full or less.
- If you stop using your tank for bathing and washing clothes when the tank is below 3/4 full, you only need a 1,400 gallon tank (red box).

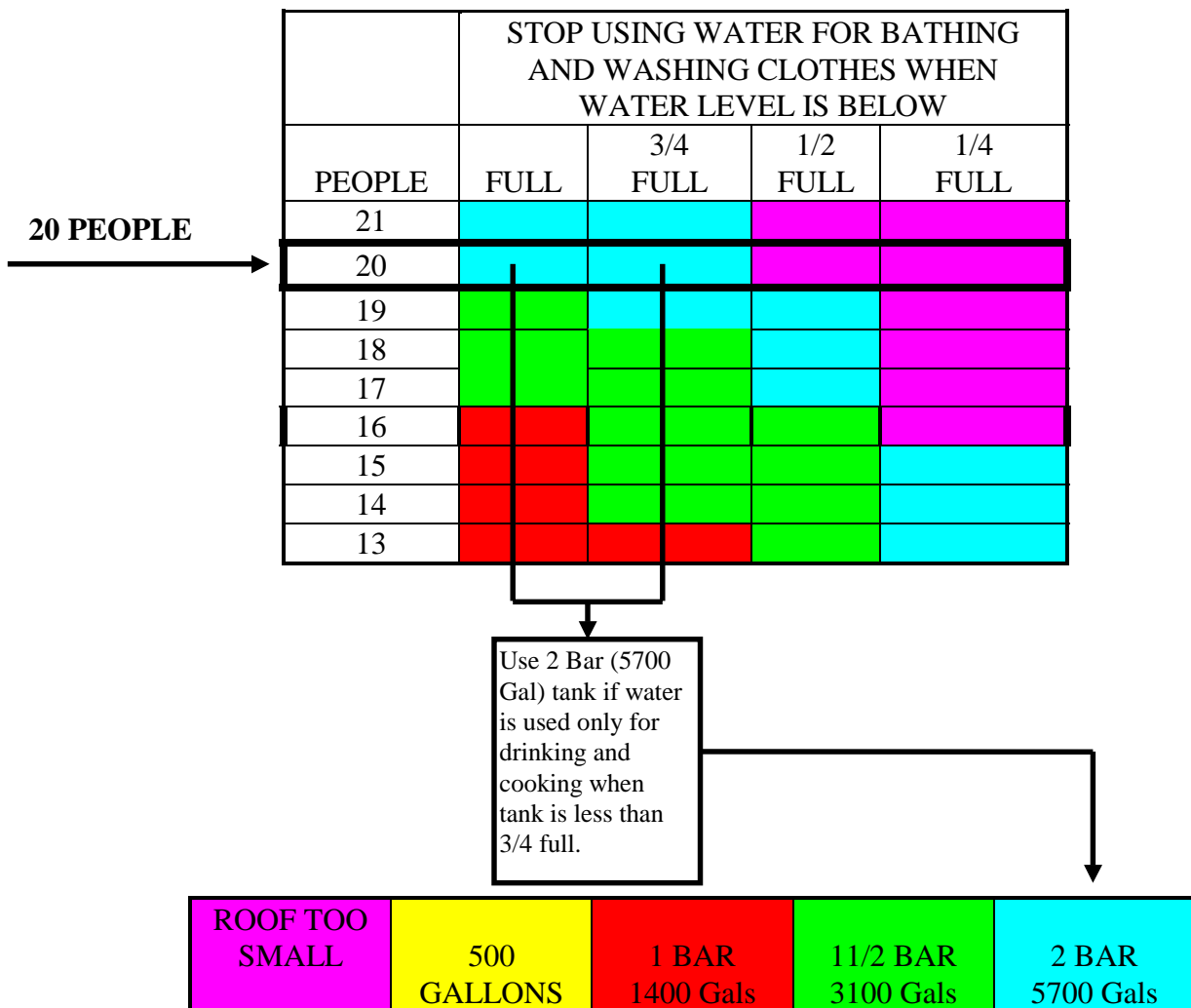
So, it is easy to see that **IF YOU CONSERVE WATER, YOU NEED A MUCH SMALLER TANK!** For this example, if you NEVER use your tank for bathing and washing clothes when the tank is less than 3/4 full , you will only need a 1,400 gallon tank (red box). If you want to start conserving water only when the tank is less than 1/4 full then a 3100 gallon tank (green box) will be required.

EXAMPLE TWO

Now suppose that your **USABLE** roof size is 1,620 square feet and you have 20 people in your home. How big should your tank be now?

Since we already know the usable roof size and the number of people, we can go right to the charts to get an answer. Your usable roof size is between 1,600 and 1,800 square feet. So, let's look at the chart for those sizes. You should find this chart on page 15 of this booklet. A copy of a part of this chart is shown below. The chart tells us that if you **NEVER** use water in your tank for bathing or washing, or if you let it decrease to 3/4 full before you stop using water for these activities, a 5,700 gallon tank (blue box) is the right size. If you would like to use your tank for bathing and washing clothes when the water level in the tank is lower than this, you will need a bigger tank than what is covered in the design charts of this bulletin.

FOR USABLE ROOF SIZE OF 1600 TO 1800 SQUARE FEET



IS THE TANK YOU ALREADY HAVE BIG ENOUGH?

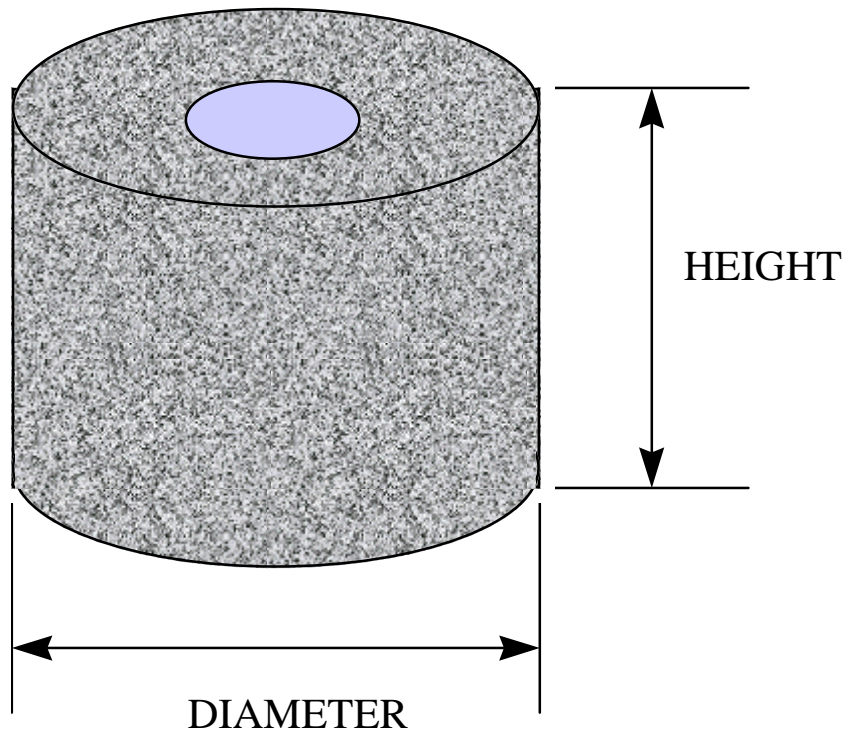
The steps that you should follow if you want to know if your OLD tank is BIG enough are exactly the same as you used to determine the size of a NEW tank except that you will also have to find out the number of gallons of water that your tank will hold. Here's the additional step:

STEP 7. Find the SIZE of your tank (in gallons). See the sketch below for a description of the terms used.

Multiply 5.87 times height times diameter times diameter.

$$\text{Tank Size} = 5.87 \times \frac{\text{Height}}{\text{Height}} \times \frac{\text{Diameter}}{\text{Diameter}} \times \frac{\text{Diameter}}{\text{Diameter}}$$

You will also have to use the charts in the back of the booklet in a slightly different way. This will be shown in Step 8 on the following page.



RAIN WATER CATCHMENT TANK

EXAMPLE THREE

Your roof is 42 feet long and 47 feet wide. You have gutters around the entire roof but they leak a lot. There are 8 people in your home. Your tank is 9.5 feet in diameter and 6 feet high. Is your tank **BIG** enough for your family?

Step 1. Length = _____ feet
 Width = _____ feet

Step 2. $\frac{\text{_____}}{\text{length}} \times \frac{\text{_____}}{\text{width}} = \frac{\text{_____}}{\text{roof size}}$

Your answer should be 1,974 square feet.

Step 3. _____ roof factor

Step 4. _____ gutter factor

Step 5. $\frac{\text{_____}}{\text{roof size}} \times \frac{\text{_____}}{\text{roof factor}} \times \frac{\text{_____}}{\text{gutter factor}} = \frac{\text{_____}}{\text{usable roof size}}$

Your answer should be approximately 1184 square feet.

Step 6. _____ people

Step 7. $5.87 \times \frac{\text{_____}}{\text{height}} \times \frac{\text{_____}}{\text{diameter}} \times \frac{\text{_____}}{\text{diameter}} = \frac{\text{_____}}{\text{tank size}}$ gallons

Your answer should be approximately 3,179 gallons.

Step 8. Now go to the chart for usable roof sizes between 1,000 and 1,200 square feet and look at the row for 8 people. Your tank is very close to the 3,100-gallon tank. So, let's look at the green boxes. The chart says that your tank is big enough for your family if you stop using the water in it for bathing and washing clothes when the level decreases below 1/4 full.

EXAMPLE FOUR

Now suppose that you have a usable roof size of 500 square feet a 1,400-gallon tank and that there are 12 people in your household. Is your tank BIG enough?

Look at the chart for usable roof sizes between 400 and 600 square feet and the row of the chart corresponding to 12 people. Since red, the color corresponding to a 1,400-gallon tank, does not appear on the chart, your tank is too small. For your family, a 5,700-gallon tank (blue box) is required and the tank water must NEVER be used for bathing or washing clothes.

HAVING TROUBLE??

The author of this bulletin is hopeful that the procedures, charts and examples will help you in designing a new or evaluating an existing roof rainwater catchment system. If you are having trouble using the charts and examples or if your system does not seem to fit the charts provided, please contact your local sanitarian or contact Dr. Leroy Heitz at the address and numbers listed on the last page of this bulletin.

CHARTS 100-200 200-400 400-600

CHARTS 600-800, 800-1000

CHARTS 1000-1200 1200-1400

CHARTS 1400 -1600 1600-1800

CHARTS 1800 TO 2000

**FOR MORE INFORMATION ON ROOF TOP RAIN WATER CATCHMENT
SYSTEMS
CONTACT YOUR STATE SANITARINAN**

OR

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| | STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN TANK IS BELOW: | | | |
|---------------|---|---------------|---------------|---------------|
| PEOPLE | FULL | ¾ FULL | ½ FULL | ¼ FULL |
| 14 | No | No | No | No |
| 13 | No | No | No | No |
| 12 | 5700 | No | No | No |
| 11 | 5700 | No | No | No |
| 10 | 5700 | 5700 | No | No |
| 9 | 5700 | 5700 | No | No |
| 8 | 3100 | 5700 | 5700 | No |
| 7 | 3100 | 3100 | 5700 | No |
| 6 | 1400 | 3100 | 3100 | 5700 |
| 5 | 1400 | 1400 | 3100 | 3100 |
| 4 | 500 | 1400 | 1400 | 3100 |
| 3 | 500 | 500 | 500 | 1400 |
| 2 | 500 | 500 | 500 | 500 |
| 1 | 500 | 500 | 500 | 500 |

| | STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN TANK IS BELOW: | | | |
|---------------|---|---------------|---------------|---------------|
| PEOPLE | FULL | ¾ FULL | ½ FULL | ¼ FULL |
| 23 | No | No | No | No |
| 22 | 5700 | No | No | No |
| 21 | 5700 | No | No | No |
| 20 | 5700 | No | No | No |
| 19 | 5700 | 5700 | No | No |
| 18 | 5700 | 5700 | No | No |
| 17 | 3100 | 5700 | 5700 | No |
| 16 | 3100 | 3100 | 5700 | No |
| 15 | 3100 | 3100 | 5700 | No |
| 14 | 1400 | 3100 | 3100 | 5700 |
| 13 | 1400 | 3100 | 3100 | 5700 |

| | STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN TANK IS BELOW: | | | |
|---------------|---|---------------|---------------|---------------|
| PEOPLE | FULL | ¾ FULL | ½ FULL | ¼ FULL |
| 19 | No | No | No | No |
| 18 | 5700 | No | No | No |
| 17 | 5700 | No | No | No |
| 16 | 5700 | 5700 | No | No |
| 15 | 5700 | 5700 | No | No |
| 14 | 3100 | 5700 | No | No |
| 13 | 3100 | 5700 | 5700 | No |
| 12 | 3100 | 3100 | 5700 | No |
| 11 | 1400 | 3100 | 3100 | 5700 |
| 10 | 1400 | 1400 | 3100 | 5700 |
| 9 | 1400 | 1400 | 3100 | 3100 |
| 8 | 1400 | 1400 | 1400 | 3100 |
| 7 | 500 | 1400 | 1400 | 3100 |
| 6 | 500 | 500 | 1400 | 1400 |
| 5 | 500 | 500 | 1400 | 1400 |
| 4 | 500 | 500 | 500 | 1400 |
| 3 | 500 | 500 | 500 | 500 |
| 2 | 500 | 500 | 500 | 500 |
| 1 | 500 | 500 | 500 | 500 |