

**DESIGNING
YOUR
RAINWATER
CATCHMENT
AND
STORAGE SYSTEM**

By

**Leroy F. Heitz
Stephen J. Winter**

WERI

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

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**Water and Energy Research Institute
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University of Guam
UOG Station
Mangilao, Guam 96923**

**These guidelines may only be used for:
All the islands of Yap State, FSM
All the islands in Namonweito Atoll, Chuuk State, FSM
All the islands in the Pattiw area, Chuuk 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 based on local rainfall conditions and is correct only for certain areas of the FSM. The charts that are provided can be used for: All the islands of Yap State, FSM, all the islands in Namonweito Atoll, Chuuk State, FSM, and all the islands in the Pattiw area, Chuuk State, FSM.

If you live somewhere other than these areas, 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 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 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 Energy Research Institute (**WERI**) for further information. The 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 all the 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 25 feet in length by 34 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

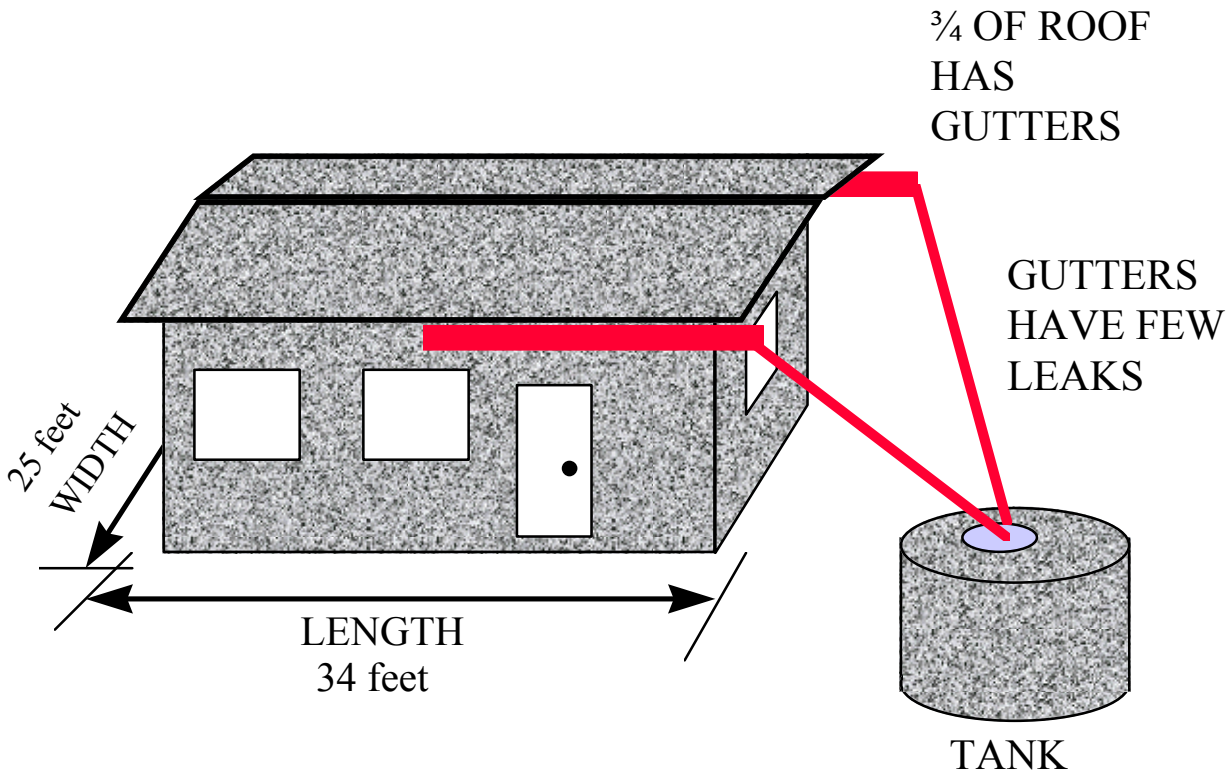
Step 2. $\frac{34}{\text{Length}} \times \frac{25}{\text{Width}} = \frac{850}{\text{Roof Size}}$ square feet

Step 3. Roof Factor = 0.75

Step 4. Gutter Factor = 0.90

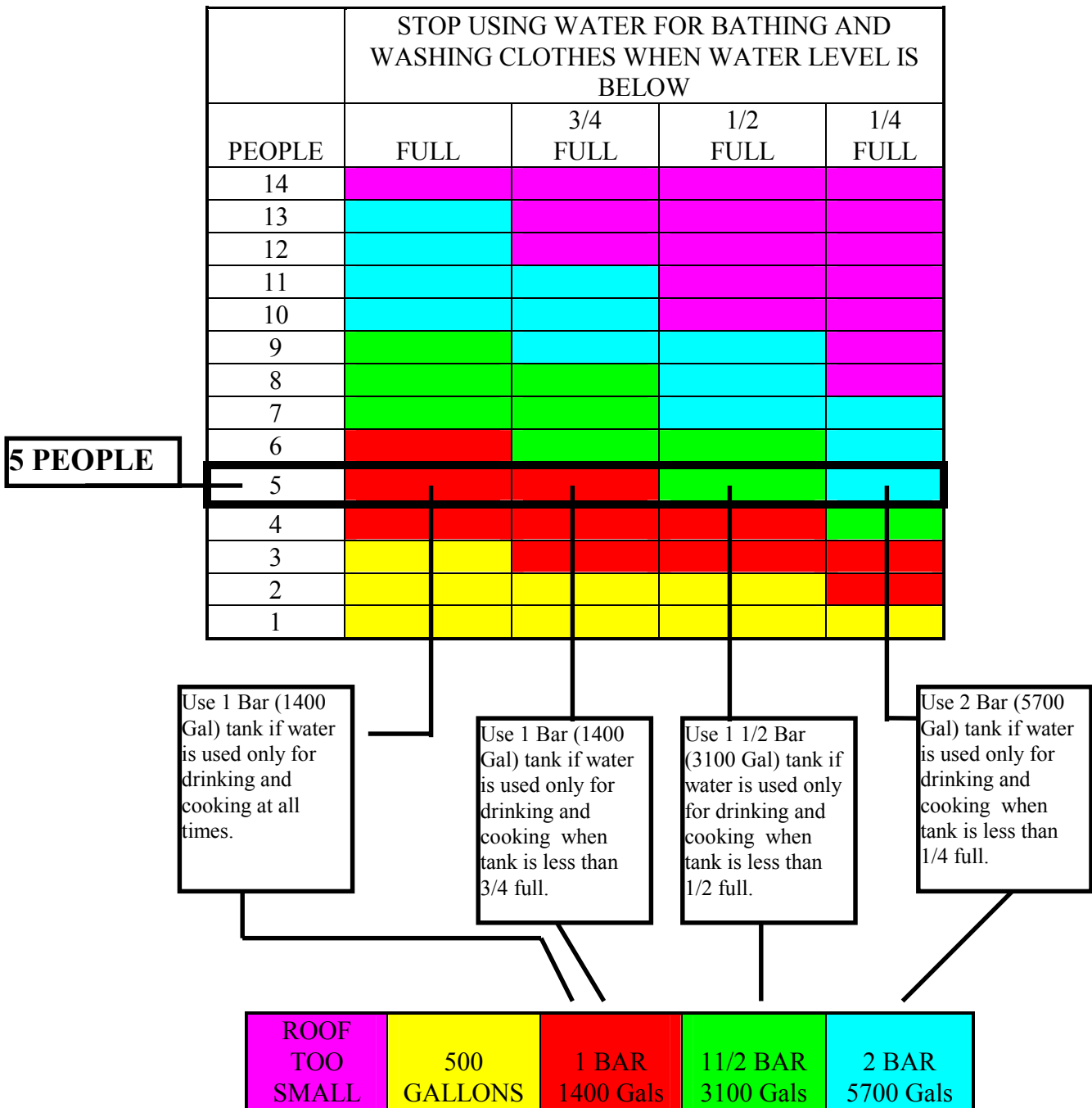
Step 5. $\frac{850}{\text{Roof Size}} \times \frac{0.75}{\text{Roof Factor}} \times \frac{0.90}{\text{Gutter Factor}} = \frac{574}{\text{Useable Roof Size}}$ square feet

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 15. The same chart is shown below for easy reference. In the left hand column locate the row labeled 5 people.

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



Step 7. 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 dishes when the tank decreases below 1/4 full, you should look in the farthest column to the right which is labeled 1/4 full. Notice this column contains a blue box in the five people row. This corresponds to a 2 Bar tank which has a capacity of approximately 5,700 gallon.
- However, if you stop using your tank for tank for bathing and washing dishes when the tank is below 1/2 full, a 3,100 gallon tank (green box) is big enough.
- If you stop using your tank for tank for bathing and washing dishes when the tank is below 3/4 full, you only need a 1,400 gallon tank (red box).

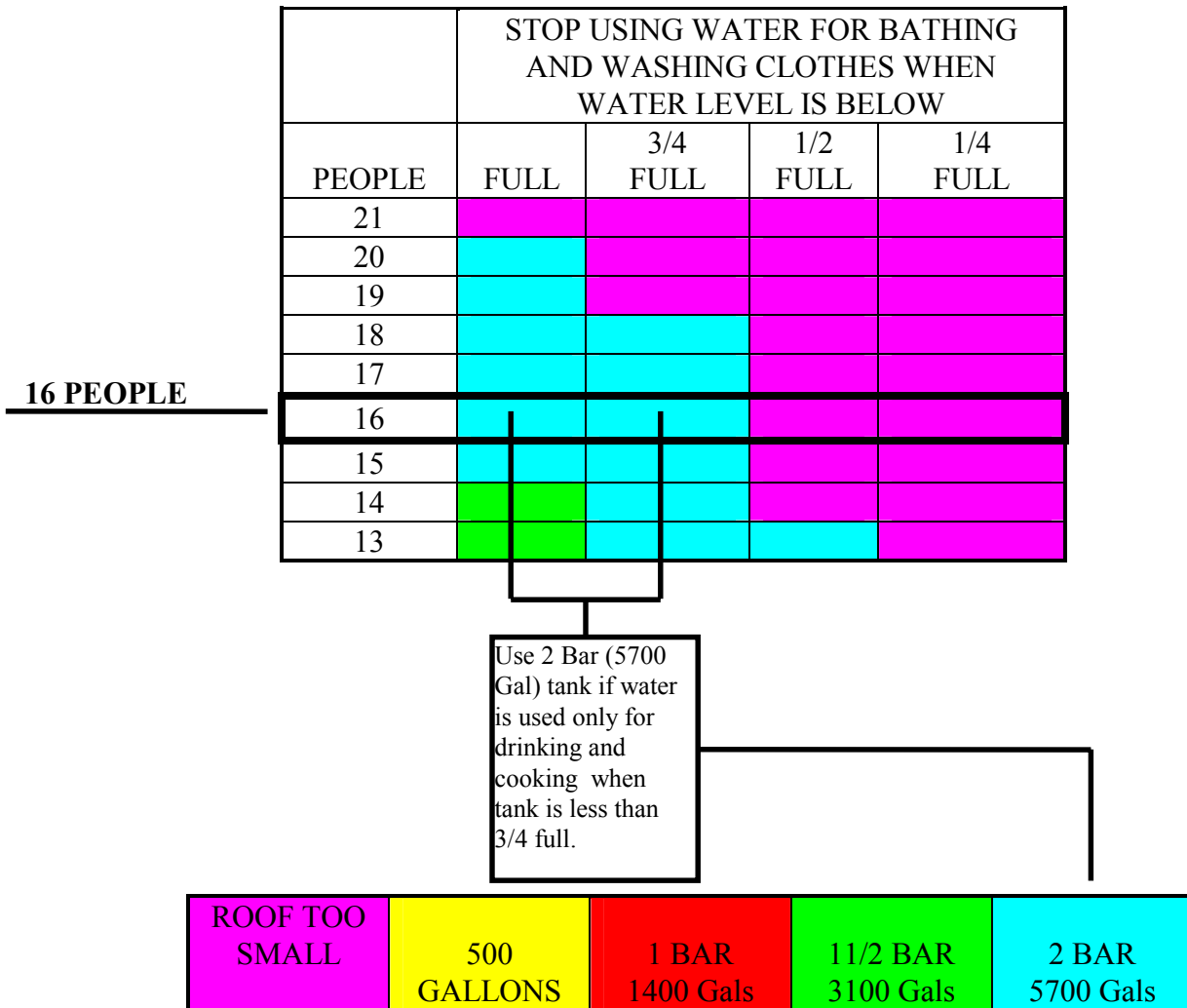
So, it is easy to see that **IF YOU CONSERVE WATER, YOU NEED A MUCH SMALLER TANK!** For this example, if you NEVER use your tank for bathing and washing clothes, you will only need a 1,400 gallon tank (red box).

EXAMPLE TWO

Now suppose that your **USABLE** roof size is around 1,590 square feet and that you have 16 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 1,400 and 1,600 square feet. So, let's look at the chart for those sizes. You should find this chart on page **Error! Bookmark not defined.** 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 clothes 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.**

FOR USABLE ROOF SIZE OF 1400 TO 1600 SQUARE FEET



IS THE TANK YOU ALREADY HAVE BIG ENOUGH?

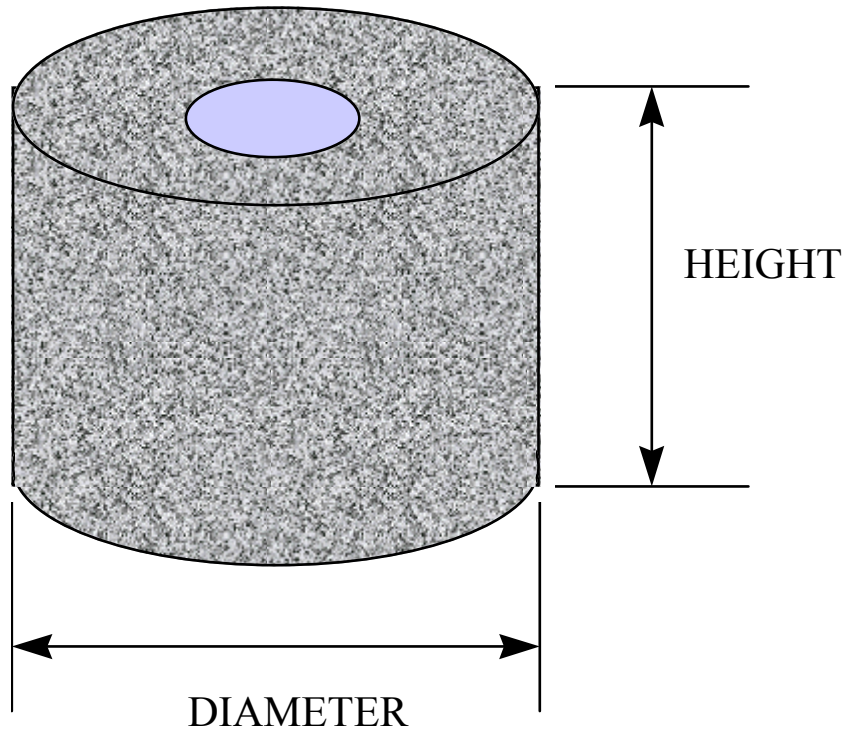
The steps that you should follow if you want to know if your OLD tank is BIG enough are exactly the same as you used to determine the size of a NEW tank except that you will also have to find out the number of gallons of water that your tank will hold. Here's the additional step:

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 it **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 1/2 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 13 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 13 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.

TANK SIZING TABLES FOR WESTERN FSM

**FOR USABLE ROOF SIZE
OF 100 TO 200 SQUARE FEET**

STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW				
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
5	Red	Red	Red	Red
4	Yellow	Yellow	Yellow	Yellow
3	Green	Green	Green	Green
2	Blue	Blue	Blue	Blue
1	Orange	Orange	Orange	Orange

**FOR USABLE ROOF SIZE
OF 200 TO 400 SQUARE FEET**

STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW				
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
10	Red	Red	Red	Red
9	Yellow	Yellow	Yellow	Yellow
8	Green	Green	Green	Green
7	Blue	Blue	Blue	Blue
6	Orange	Orange	Orange	Orange
5	Red	Red	Red	Red
4	Yellow	Yellow	Yellow	Yellow
3	Green	Green	Green	Green
2	Blue	Blue	Blue	Blue
1	Orange	Orange	Orange	Orange

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

STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW				
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
14	Red	Red	Red	Red
13	Yellow	Yellow	Yellow	Yellow
12	Green	Green	Green	Green
11	Blue	Blue	Blue	Blue
10	Orange	Orange	Orange	Orange
9	Red	Red	Red	Red
8	Yellow	Yellow	Yellow	Yellow
7	Green	Green	Green	Green
6	Blue	Blue	Blue	Blue
5	Orange	Orange	Orange	Orange
4	Red	Red	Red	Red
3	Yellow	Yellow	Yellow	Yellow
2	Green	Green	Green	Green
1	Blue	Blue	Blue	Blue

ROOF TOO SMALL	500 GALLONS	1 BAR 1400 Gals.	1 1/2 BAR 3100 Gals.	2 BAR 5700 Gals.
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TANK SIZING TABLES FOR WESTERN FSM (CONTINUED)

**FOR USABLE ROOF SIZE
OF 600 TO 800 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
15				
14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

**FOR USABLE ROOF SIZE
OF 800 TO 1000 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
17				
16				
15				
14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

ROOF TOO SMALL	500 GALLONS	1 BAR 1400 Gals.	1 1/2 BAR 3100 Gals.	2 BAR 5700 Gals.
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TANK SIZING TABLES FOR WESTERN FSM (CONTINUED)

**FOR USABLE ROOF SIZE
OF 1000 TO 1200 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
18	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
17	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
16	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
15	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
14	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
13	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
12	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
11	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
10	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
9	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
8	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
7	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
6	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
5	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
4	500 GALLONS	1 1/2 BAR	1 BAR	1 BAR
3	500 GALLONS	1 1/2 BAR	1 BAR	1 BAR
2	500 GALLONS	1 1/2 BAR	1 BAR	1 BAR
1	500 GALLONS	1 1/2 BAR	1 BAR	1 BAR

**FOR USABLE ROOF SIZE
OF 1200 TO 1400 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
20	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
19	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
18	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
17	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
16	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
15	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
14	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
13	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
12	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
11	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
10	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
9	2 BAR	1 1/2 BAR	1 BAR	500 GALLONS
8	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
7	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
6	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
5	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
4	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
3	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
2	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS
1	1 BAR	1 1/2 BAR	1 BAR	500 GALLONS

ROOF TOO SMALL	500 GALLONS	1 BAR 1400 Gals.	1 1/2 BAR 3100 Gals.	2 BAR 5700 Gals.
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TANK SIZING TABLES FOR WESTERN FSM (CONTINUED)

**FOR USABLE ROOF SIZE
OF 1400 TO 1600 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
21				
20				
19				
18				
17				
16				
15				
14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

**FOR USABLE ROOF SIZE
OF 1600 TO 1800 SQUARE FEET**

	STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW			
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
23				
22				
21				
20				
19				
18				
17				
16				
15				
14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

ROOF TOO SMALL	500 GALLONS	1 BAR 1400 Gals.	1 1/2 BAR 3100 Gals.	2 BAR 5700 Gals.
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**TANK SIZING TABLES FOR WESTERN FSM
(CONTINUED)
FOR USABLE ROOF SIZE
OF 1800 TO 2000 SQUARE FEET**

STOP USING WATER FOR BATHING AND WASHING CLOTHES WHEN WATER LEVEL IS BELOW				
PEOPLE	FULL	3/4 FULL	1/2 FULL	1/4 FULL
24	Red	Red	Red	Red
23	Orange	Red	Red	Red
22	Orange	Red	Red	Red
21	Orange	Red	Red	Red
20	Orange	Red	Red	Red
19	Orange	Orange	Red	Red
18	Orange	Orange	Red	Red
17	Orange	Orange	Red	Red

16	Green	Orange	Red	Red
15	Green	Orange	Orange	Red
14	Green	Orange	Orange	Red
13	Green	Green	Orange	Red
12	Green	Green	Orange	Orange
11	Green	Green	Orange	Orange
10	Red	Green	Green	Orange
9	Red	Green	Green	Orange
8	Red	Red	Green	Green
7	Red	Red	Red	Green
6	Yellow	Red	Red	Green
5	Yellow	Yellow	Red	Red
4	Yellow	Yellow	Yellow	Red
3	Yellow	Yellow	Yellow	Yellow
2	Yellow	Yellow	Yellow	Yellow
1	Yellow	Yellow	Yellow	Yellow

ROOF TOO SMALL	500 GALLONS	1 BAR 1400 Gals.	1 1/2 BAR 3100 Gals.	2 BAR 5700 Gals.
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**FOR MORE INFORMATION ON ROOF TOP RAIN WATER CATCHMENT
SYSTEMS
CONTACT YOUR STATE SANITARINAN**

OR

**UNIVERSITY OF GUAM WATER AND ENERGY RESEARCH INTITUTE
WERI
UOG STATION, MANGILAO, GUAM
96923**

**Telephone: 671-735-2685
Fax: 671-734-8890**

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