Ohio Department of Natural Resources
Division of Soil and Water Resources
Fact Sheet

Fact Sheet 94–35

Low Yield Wells: Water Supply Systems

This fact sheet focuses on methods of determining water usage and designing water supply system to meet daily demand. After completing a well, the first thing to do is to determine the long term yield of the well. If a well has a sustained yield of less than five gallons per minute (gpm), measures must be taken to ensure an adequate supply throughout the day. This would entail the intermediate storage of water either in the borehole or in a variety of holding tanks. In a suspected low yielding area, the drilling contractor should evaluate the water demands of the household and then develop a water supply system that will meet that demand. There are basically two ways to determine the water demand and to develop a plan to meet that usage. One is to determine the total daily usage (50-100 gallons/person/day), and then utilize intermediate storage tanks to meet that demand. The other method is to determine the peak demand, taking into account the number of bathrooms & bedrooms in the house and then utilizing safe well yield and borehole storage to meet the demand.

Intermediate Storage Tanks

To determine the size of storage tanks needed for a job, multiply the number of people living in the house by 100 gallons. This value will be the number of gallons needed per day for household use. Design the storage system to hold at least this amount of water. There are a number of different non-pressurized storage vessels available for domestic water supply. Possibilities include steel, plastic and concrete tanks in a variety of sizes. Storage tanks can be buried in the yard (i.e. preformed concrete), be above ground, or better yet, be placed in the garage or basement (away from weather). Smaller size tanks can be connected together in a series and placed near the pressure tank and hot water tank. The use of smaller tanks is advantageous for pre-existing structures due to ease of installation and maintenance. Preformed concrete storage units are advantageous when a large amount of water is desired for outside use, e.g. fire protection or livestock, and can be equipped with an access cover to allow water to be hauled in if necessary.

When using an intermediate storage system it is important to keep a few things in mind concerning the well pump. Size the pump to the safe capacity of the well. Throttle the well pump down to a level which allows enough water to be pumped but at a rate that does not lower the water level in the well substantially. If the aquifer will yield two gpm, then install a two gpm pump. Use a low level cut-off switch to avoid overheating the well pump. Extreme fluctuations of the water level in the well will cause oxidation of minerals on the borehole wall, which will decrease the well yield considerably over time. A float switch in the storage tank should operate the well pump. It is important to make sure that the well pump runs for at least two minutes each time it is started to prevent excessive wear on the motor. To properly size the pump that withdraws water from the storage tank, see Table 1. This table recommends flow rates dependent on the number of bedrooms and bathrooms.

Table 1. Recommended flow rates for home water system.

No of Bedrooms	Number of bathrooms in home			
	1	**1.5**	**2**	**3**
2	6	8	10	12
3	8	10	12	14
4	10	12	14	16
5	12	13	15	17
6	13	15	16	18
	Flow rate in gallons per minute			

(Modified from Private Water Systems Handbook)

Borehole Storage

If the homeowner does not want to install an intermediate storage system, how can you determine if the well will meet daily demands? One formula developed by the Connecticut Well Drillers Association takes into account the safe yield of the well along with well bore storage, and has related that to the peak demand needs

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and time frames. The two formulas calculate the peak usage and the peak time in which that water needs to be delivered. It is estimated that each person uses 100 gallons per day, and that there are two peak water use times of the day. Using these assumptions, the peak demand will be 50 gallons x the number of people living in the house. The peak time in which this amount of water has to be available is equal to the peak demand divided by the number of bathrooms x 3 gpm. Three gpm is used because that is the average flow rate through a standard faucet. After the peak demand and time frame have been calculated, evaluate the safe yield of the well along with the available water in well storage. Here is an example:

A family of five live in a three bedroom, two bath house. The peak demand would be 50 times 5 or 250 gallons of water.

	50	gallons at peak demand per person
x	5	number of people in house
=	250	gallons needed for peak time use

The peak time in which this water has to be delivered is equal to 250 divided by (3x2 bathrooms) or 42 minutes to meet this family's water needs.

	250	total gallons needed at peak demand
÷	6	(3 gallons per minute x 2 baths)
=	42	(41.6 rounded) peak time in minutes

If the safe yield of the well is two gpm, the well would need to have 166 gallons of water above the pump in the well to meet this homes peak demands.

	250	total gallons needed at peak demand
-	84	42 min. x 2 gpm safe well yield
=	166	gallons of water needed above pump

Well storage is determined by the well diameter, the depth of pump placement, and the static water level. There are two ways to increase well bore storage: drill a larger diameter borehole or drill deeper than the source of water. Either method would result in more water being available to be pumped out of the well as needed. Table 2 shows the storage capacity of different diameter well casing.

Table 2. Storage capacity of well casing.

Well Diameter (in inches)	Storage capacity (in gallons) per foot of water
4	0.653
5	1.02
6	1.47
8	2.61
10	4.08
12	5.87

From this table it can be seen that drilling an eight-inch diameter well will yield approximately 1.5 more gallons per foot that a five-inch well (2.61-1.02).

Drilling the borehole deeper could be a beneficial method of storage if the additional drilling does not encounter ground water of a poorer quality. Drilling a larger borehole to a shallower depth is recommended over drilling a well deeper into a relatively non-water-bearing formation. To avoid this possibility, installation of an intermediate storage and two-pump system is recommended.

Whatever system is installed, it is very important that operation and maintenance procedures of the system be understood. Also, low flow fixtures should be installed. These measures will allow for a less stressed water supply system which could add years of life to the mechanical parts and to your sanity.

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