ALABAMA COOPERATIVE Extension SYSTEM

ALABAMA A&M AND AUBURN UNIVERSITIES

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Water Supply Wells
Constructing A Well

Are you planning a new home on a site that is not served by a community water system? Or are you thinking of replacing your water well with a new well? If so, you can protect both your family's health and the market value of your home by thoughtfully planning the installation of a new well.

Before beginning construction, you must choose a well contractor, determine your family's water requirements, and select a safe location for the well. Constructing the well—the best methods and the appropriate components—can be determined by local or state laws and the contractor. After construction, you must make sure that the well is developed, tested, and disinfected.

Choosing A Well Contractor

Well construction is a specialized trade. Most well drillers want to do a proper job because they know that a good well is their best advertisement. The State of Alabama has specific requirements that well drillers and pump installers must meet yearly to be licensed. A list of water well drillers licensed in Alabama is included in the appendixes.

Local well contractors are listed in the classified telephone directory. You also can ask your county Extension agent, health officer, bank representatives, pump dealers, and neighbors to recommend a local well contractor. Check on the contractor's reliability, reputation, length of establishment, and satisfied customers.

A well contractor should be willing to provide a standard contract specifying the materials to be used, how the well is to be finished, and the diameter of the well. The contract must specify that the well is to provide potable water at an adequate rate for your use.

Most contractors drill wells at a flat rate of so much per foot because of the uncertainty of depth to water. Often a minimum fee equivalent to 75 to 100 feet of well is required. In this case a well of lesser depth would cost the minimum fee. A well of greater depth would cost the minimum fee plus the flat rate for additional depth.

The construction cost of a well usually covers only the work and materials required for the well. It does not include the pumping system, plumbing and electrical work, and materials necessary to get the water from the well to the point of use. The well contractor probably is qualified to perform this service. If so, the contract should specify the materials and total cost for completing the water system. This work may cost as much or more than the well itself. However, when you purchase the well and the complete pump installation from the well contractor, you give him or her full responsibility for adequate water service.

A Checklist For Well Construction

When contracting to install a well, be sure to find answers to these questions:

What is the water yield that will be sought?

What is the minimum yield that will be accepted if difficulties are encountered?

What is the maximum depth to drill if satisfactory amounts of water are not encountered?

Does the written estimate cover costs of the following:

- Drilling (per foot).
- Well casing materials (per foot).
- Surface sanitary sealing.
- Sealing material (such as grout).
- Excavations for piping from well to house.
- Submersible or other type of pump, piping into house, and all other required equipment.
- Pressure tank inside the house.
- "Dry" holes.
- Well drilling permit.

When will the work start?

How long is construction likely to take?

Is the contractor responsible for guaranteeing a certain quantity or quality of water?

What is the contractor's right of access onto the site?

Will there be any necessary disruption to existing land and vegetation?

How will the debris from the drilling operation be disposed?

Is the contractor free of liability for injuries not caused by the contractor's negligence?

Does the contractor provide future maintenance services? If not, who will?

Will the contractor furnish a well log when the work is completed? (Such a log will include details of the well's construction and the pumping, pressure, and drawdown testing if required.)

Determining Water Requirements

The average amount of water used for farm and domestic supplies is 65 to 75 gallons per person per day, but a more accurate estimate should consider your household's size and lifestyle. Table 1 may assist you in determining water requirements.

Table 1. Planning Guide For Water Consumption.

Homes, Farms, Urban Areas	Gallons Per Day
Livestock, per head	
dairy cow	35
beef or steer cow	12
heifer	12
hog	4
horse or pony	12
sheep or goat	2
Poultry, per 100	
chickens	5 to 10
turkeys	10 to 18
Dwellings, per person	
single family home	50 to 75
seasonal cottage	50
institution	75 to 125
Country Clubs, per member	25
Service Station, per vehicle	10
Swimming Pool	10

Source: Woodling 1988.

Your well must be able to supply enough water to meet the needs of your family during periods of intensive use when people are bathing, washing laundry, watering the lawn, or filling a pool. The well's ability to supply water during peak periods largely depends on the rate at which water flows to the well, which is usually measured in gallons per minute. The amount of water normally expected from a domestic well is 4 to 10 gallons per minute. The demand flow for various fixtures is given in Table 2.

Table 2. Demand Flow For Various Fixtures.

Fixture	Gallons Per Minute
Automatic clothes washer	5
Basin faucet	3
Bathtub or shower	5
Kitchen sink	5
Toilet flush tank	4
Garden hose, 1/2-inch	3
Lawn sprinkler	3 to 5

Source: Woodling 1988.

Locating The Well

Whether a well taps water just below the ground or hundreds of feet down, its location on top of the ground is a crucial safety factor. Locating a well in a safe place takes careful planning and consideration of several factors.

First, the well must be located within your property lines. The exact distance that it must be from property lines may be governed by local codes.

Next, it is important to locate a well where it can be easily maintained and serviced. A permanent structure built over a well can interfere with servicing, and power or phone lines can interfere with a well drill-rig mast. If you must drill next to a building, locate the well at least 2 feet beyond the drip line of the roof eve.

Finally, the most important factor in your well's safety is the location of the well in relation to possible sources of pollution. Both the direction of water flow and the distance from sources of contamination should be considered.

Direction Of Water Flow. The direction water flows and carries pollutants can affect the safety of your well. Contaminants may flow around or down the outside of the well to groundwater. To protect groundwater, direct surface drainage away from the well.

Once a contaminant enters groundwater, the direction that it flows may not be indicated by surface slope. While groundwater flow in a shallow aquifer is often in the same direction as surface water flow, a deeper aquifer may have a different slope and a different direction of flow than is indicated by the land surface. To find out the direction groundwater flows in your area, contact a well driller, an engineering firm, or the Water Resources Division of the Geological Survey of Alabama in Tuscaloosa (205-349-2852).

Ideally, the well should be located on the side of the contaminant source opposite the direction of groundwater flow and on the highest ground available. For example, if you know groundwater flows to the south, place the well as far north of the contaminant source as possible. This will help prevent con-

taminated runoff water and other materials from entering your well.

Distance From Sources Of Contamination. The distance that your well must be from sources of contamination will vary with the soil type. Some general guidelines for setback distances from common sources of contamination are given in Table 3. These setback distances apply to clay and loam textured soils; they should be increased for more permeable soils. For example, these distances should be doubled for highly permeable, coarse-textured soils such as loamy sand.

Table 3. Recommended Minimum Setback Distances For Common Sources Of Contamination.

Source Of Contamination[a]	Setback Distance[b]
Lake, pond, or stream; cistern; sump, pit, drywell, or nonpotable well.	25 feet
Animal or poultry yard; sewage holding tank; buried sewer; septic tank.	50 feet
Cesspool; below-grade manure storage; petroleum tank and products; septic absorption field; pesticide and fertilizer storage tank; chemical or fertilizer preparation area.	100 feet
Liquid waste disposal system; manure stack and manure storage structure.	250 feet

[a]For sources of contamination not addressed, use a minimum of 50 feet separation.

[b]These are recommended distances for private wells. State and local ordinances may require different separation distances, especially for public water supply wells.

Sources: Minnesota Department of Health, Alabama Department of Public Health, 1988 and Alliance for a Clean Rural Environment, 1991.

Methods Of Well Construction

Wells generally are classified according to the method of construction. Wells can be driven or drilled. Older types of wells such as dug wells are limited in depth and are subject to contamination from surface water seepage. Shallow wells are no longer allowed by many state health departments.

Driven wells are the quickest and least expensive method of acquiring groundwater. They are most practical where the well depth does not exceed 50 to 60 feet. Driven wells are constructed by forcing an assembled length of pipe fitted with a well point and screen through the soil. This process requires porous, relatively loose soil containing no rock.

Drilled wells are installed when greater volume, depth, or diameter are required. Two methods of drilling are the hydraulic rotary method and the cable-tool method.

The hydraulic rotary method of drilling uses a bit attached to the lower end of a vertical shaft which consists of sections of drill pipe that are screwed together. As the drill pipe is rotated and lowered, the bit cuts its way through the earth. At the same time a water and mud mixture is pumped down through the center of the pipe and the bore hole. This mud fluid carries bore material away from the bit and keeps the hole from caving in. The well casing is placed in the bore hole after the well has been drilled. The complete casing pipe is placed in one operation and then grouted into place.

In cable-tool drilling a heavy steel bit is suspended on a cable and alternately dropped and picked up to pulverize the earth below it. Water and earth form a sludge which is bailed out from the hole as necessary with a tool called a bailer. The steel pipe casing is placed as the well drilling progresses. The casing fits tightly and is driven from time to time to sink in as required. The earth hugs the pipe tightly and grouting generally is not required.

Parts Of A Well

Long-term sanitary protection for a well begins with the casing. See Figure 1. **Casing** prevents surface runoff and shallow groundwater from entering the well and contaminating the desirable water that is generally found in deeper soil formations.

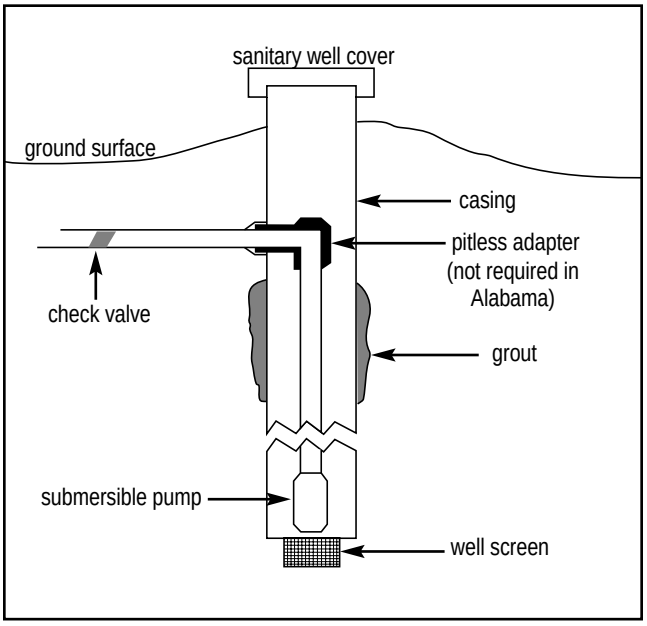

Figure 1. Parts of a well (not to scale).

Steel pipe is most often used for casing drilled, small-diameter wells because it must withstand stress during installation, pressure from surrounding earth materials, and corrosive soil and water. In some parts of the country, thermoplastic casing is becoming popular. Under extremely corrosive conditions, stainless steel casing may be necessary. For bored large-diameter wells, concrete and fiberglass casings are also used.

The depth of casing required for a well depends on the nature of the subsurface geologic materials, groundwater levels, and code requirements. The well casing should extend at least 50 feet below the water table of the aquifer supplying your well. This ensures that surface water is filtered through soil and geologic materials before entering the well. Meeting well code minimums does not, however, guarantee a safe water supply. Since most contamination comes from the surface, casing the well deeper can provide greater protection. For help, call the Alabama Department of Environmental Management, Water Division, Water Supply Branch, Non-Community Section.

The bottom of the casing must be fitted with a **well screen** which allows water to enter the well freely but prevents the entrance of coarse sand. Screens must be of sufficient strength to maintain the shape of the well bottom. The material should be resistant to the chemical action of the groundwater. Stainless steel, bronze, or brass are used most commonly in well screens. The selection of the screen material usually is based on the cost of the material and the chemical character of the water. Recently, there has been concern about lead leaching from brass screens.

The upper part of the well casing must be sealed artificially where clay, hardpan, shale, or other stable material overlays waterbearing sand or gravel. Sealing is usually done with **grout,** which can be concrete or a special type of clay called bentonite depending on the geologic materials encountered. Both grout and casing prevent pollutants from seeping into the well.

The upper end of the casing pipe can terminate on a pump house floor, a platform, or the soil surface. The casing should extend at least 6 inches above this surface. The casing must extend at least 2 feet above any maximum known flood water elevation to prevent surface water run-in. The entrance of any pump pipes, cable, airlines, or other device into the well casing must be effectively sealed. A **sanitary well cover** should help keep the well sanitized.

The well **pump** may be either mounted directly over the well, offset from the well, offset from the casing with pipes buried below the soil surface, or submerged in the well above the well screen. Where the pump is mounted directly over the well, a sanitary well seal should be used. If the pump is offset from the well, the seal should consist of a water-tight, expanding-type seal that fits into the casing and at the same time seals the drop pipes, cables, and airline. If the pump is offset from the casing with pipes buried below the soil surface or if the pump is submerged in the well, a sealing device termed a **pitless adapter** is used. In this case the top of the casing still projects above the soil level and is fitted with a protective cap. Pitless adapters are commonly used in cold climates to keep pipes below the winter freeze depth. This is not necessary in Alabama.

Antibacksiphoning (check) valves should be installed between the well and the water pipes. If water pressure is lost even momentarily, these devices prevent siphoning contaminants into the well.

After Construction

Once the drilling has been completed and the casing and screen have been placed, the well should be "developed." A well is developed to clean the water intake spaces and to allow the maximum rate of water entry to the well. This process involves pumping to remove all sediment leftover from the drilling process. The well is then surged using compressed air or washed with a water jet to cause water to move in both directions through the water-bearing strata at the well intake.

The well is then tested for yield. For residential wells, testing usually is done by bailing or with compressed air. This type of test usually is included in the cost of the well. An actual pumping test for capacity in gallons per minute with measurement of water level decline or "drawdown" requires additional cost but is justified for irrigation or other wells where reliable high yield is necessary.

Finally, the well and pumping equipment should be disinfected before being placed into service. The well should be thoroughly cleaned of all foreign substances. Disinfect with a chlorine solution poured into the well at a rate dependent on the well size and water storage capacity. After 8 hours or more, the water is then pumped until the amount of chlorine has been reduced sufficiently. This water might burn shrubs and grasses and should be disposed of where damage will be minimal.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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