Improving Drinking Water Well Condition

Keeping Idaho's Water Clean

This set of materials addresses well conditions for non-public (i.e. private) drinking water systems. What is a non-public drinking water system? In Idaho, there are two types of water systems: public and non-public. A public water system serves at least 15 connections or at least 25 individuals daily for at least 60 days of the year and is regulated by the Idaho Department of Environmental Quality (DEQ). All other drinking water systems are considered to be non-public, and the day-to-day operation of these wells is not regulated. Both public and non-public wells, however, have minimum construction standards that are regulated by the Idaho Department of Water Resources (IDWR) under IDAPA 37.03.009, Well Construction Standards Rules.

The design, construction, operation and maintenance of a well can significantly impact water quality. Thus, it is important to consider actions to prevent the contamination of your drinking water supply for today and for the future.

1. Well Location

Whether a well taps water just below the ground surface or hundreds of feet deep, its location at the ground surface is a crucial safety factor. Locating a well in a safe place takes careful planning and consideration of factors such as where the well is located in relation to surface drainage, and ground water flow. A well down-slope from an animal feedlot, a leaking fuel tank, or a failing septic system runs a greater risk of contamination than a well on the uphill side of these potential pollution sources. The general rule for protecting the water supply is to **keep a well up-slope** (or upgradient (i.e. opposite of ground water flow direction)) **and as far as possible from potential sources of contamination.**

Surface slope does not always indicate the direction a pollutant might flow once it gets into the ground. In the shallow aquifers, ground water flow is usually in the same direction as surface water flow. However, if the aquifer supplying water to your well is deep below the surface, the direction of ground water flow may be different than that of surface water flow.

Separation distances

Many states encourage good well location by requiring minimum separation distances from sources of potential pollution, thus using the natural protection provided by soil. Section 25 of the IDWR Well Construction Standards Rules requires that constructed wells must meet all siting and distance requirements set forth by the appropriate public health districts and DEQ rules. **In many Idaho counties, the local public health district or planning and zoning department may have specific regulations requiring greater separation from some potential contamination sources. However, there is no specific distance that will guarantee that the well will not be affected.** Make every effort to always provide as much separation as possible between your well and any potential contamination source (s), such as septic tanks and drain fields.

Both soil type and slope can make siting a well tricky business. Keep in mind that separation

distances listed by the state are minimums. You may want to choose greater separation distances in some cases, depending on factors at your well site. All surface runoff should be diverted away from the well. Be sure to consider possible contamination sources from adjacent properties as well.

Changing the location of the contamination source (s) in relation to your well may protect your water supply, but not the ground water itself. Any condition likely to cause ground water contamination should be improved, even it your well is far away from the potential source (s). Whether or not drinking water is affected, ground water contamination is a violation of Idaho law.

Simply separating your well from a contamination source may reduce the chance of contamination, but it does not guarantee that the well will be safe. For example, stormwater can transport bacteria, oil products, and pesticides which can wash into an improperly constructed well. Also, wells can become impaired by contaminated water recharging the aquifer from a considerable distance, depending on the depth of the aquifer, geology, and well intake.

2. Well Construction

Proper well design reduces the risk of contamination by sealing the well from anything that might enter it from the surface (Figure 1). Poor design can allow a well to become contaminated by letting rain or snowmelt reach ground water without filtering through the soil. Wells constructed without grout or a sanitary well seal, can allow ground water or surface water to carry bacteria, pesticides, fertilizer, or petroleum products into your drinking water supply by providing a pathway for contaminants between the formation and the well casing or the land surface and the well casing. Older wells drilled prior to the Well Construction Standards Rule (1987), may not be properly designed to prevent contamination.

Several items concerning well construction that should be checked are described in the following sections. Well construction information my be available from the person who drilled your well, the previous owner, or the well construction report. The IDWR has copies of well construction reports (well logs) on file. You may contact any IDWR office in the state to request a copy. IDWR also has well logs available for on-line viewing; however not all well logs are available on-line. The on-line well logs can be accessed by searching at www.idwr.idaho.gov/water/well/search. The street address of the well or legal location of your well, reported by township, range, section (1/4 of a 1/4 section or 40 acres), and the name of the original well owner will be needed to locate your well log.

Well construction reports, for wells drilled prior to 1987, were not required to filed with IDWR and therefore may not be readily available; however well logs do exist for some wells drilled prior to 1987. If your well was drilled prior to 1987, it is still a good idea to search IDWR's website or contact the IDWR State Office for a copy of the well log.

The following overview of well construction and inspection can help you understand your drinking water contamination risk ranking. For more information, contact a well driller licensed by the state of Idaho, or any IDWR office in the state (see *Contacts and References* section).

Casing, grout, pitless adapter, and well seal

The well driller installs a steel pipe (casing) during construction to prevent collapse of the borehole. All openings in the casing should be sealed, and if water pipes exit through the side

of the casing, they must do so through an approved fitting called a pitless adapter.

The space between the casing and the sides of the borehole provides a direct channel for surface water and contaminants to reach ground water. To seal off that channel, the driller fills the space with grout (cement, neat cement, or a special type of clay called bentonite). The grout seal should extend at least 18 feet in depth from the ground surface with the ground surface sloping away from the well in all directions. This will cause surface water to flow away from the well.

You can visually inspect the condition of your well casing for holes or cracks at the surface, or look down inside the casing with a light or mirror. If you can move the casing by pushing against it, you have a problem with your well casing's ability to keep out contaminants. Check on the condition of your well casing by listening for water draining down into the well (pump should not be running). If you hear water, there could be a crack or hole in the casing, or your casing does not extend down to the water level in the well. Either situation puts your drinking water source at risk.

To prevent contaminants from getting down inside the well casing, regulations require the driller to weld a thick solid, new or like-new steel plate in-place or install a tight-fitting, threaded cap or sanitary seal cap to prevent easy removal by children or entry of insects or surface water (IDAPA 37.03.09.025.02(a)). The cap should be firmly installed, with a screened vent incorporated into it so that air can enter the well. If your well has a vent, be sure that it faces the ground, is tightly connected to the well cap, and is properly screened to keep insects out. Check the well cap to see that it is in place and tightly secured. Electrical wires entering the well should be in an approved conduit. It is important to check the conduit often for damage. If the conduit is broken or pulled out of the cap due the ground settling, it can provide a pathway for contamination to get into the well.

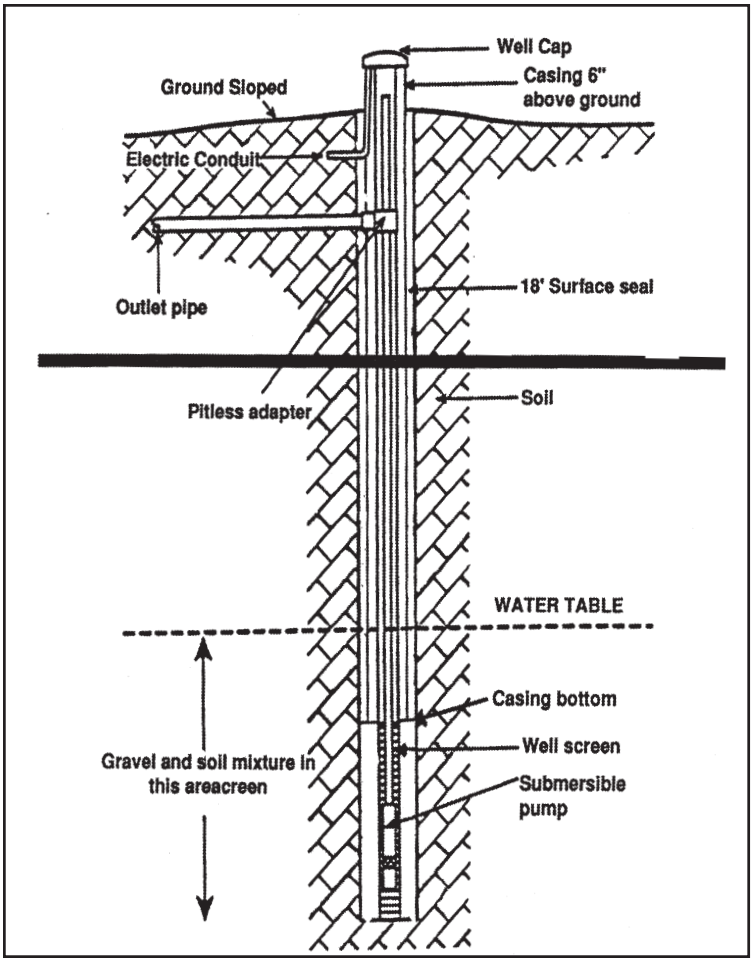

Figure 1. Typical construction compents for a well.

Casing depth and height

As stated in Idaho Well Construction Standards Rules Section 025.02 (a), all wells are required to have a durable, watertight casing that extends to a minimum depth of 18 feet below ground level. This ensures that water is filtered through soil and geologic materials before entering the well. Since most contamination comes from the surface, grouting and a deeper casing can provide greater protection. You may even want to consider exceeding the minimum casing depth in order to be more protective.

Typically, the casing extends one to two feet above surrounding land to prevent surface water from running down the casing or on top of the seal and into the well. For water wells and injection wells, Idaho regulations require that the casing extend at least twelve (12) inches above land surface and finished grade. The siting of a well in areas that are subject to flooding is strongly discouraged. Check with IDWR for regulations concerning casing construction and minimum specifications.

Well age

If you have an older well, you may want to have it inspected by a licensed well driller. Older well pumps are more likely to leak lubricating oils, which can contaminate the ground water. In addition, older wells are also more likely to have a thinner casing that has corroded through. Even 30 to 40 year old wells with modern casings are subject to corrosion. Current standards require well casings be at least 0.145 inches thick for a nominal size of 1 1/2 inches (refer to IDAPA 37.03.03.025.02(a) for a table of other nominal sizes and nominal wall thicknesses). Wells drilled before this standard could have casings with a thickness less than the current requirement, and could be subject to corrosion.

Older wells may also have older pumps that have mercury seals. Pumps should not be worked on while braced on the well casing. If the pump has a mercury seal, then when the motor is removed from the housing, the seal could break and drain mercury into the well.

Well type

Dug wells may be at the highest risk for contamination. They are shallow and are often poorly protected from surface water. A dug well is a large-diameter hole, typically three to six feet wide, which is often constructed by hand and lined with rock, brick or concrete. Hand dug wells as small as two feet and larger than 30 feet in diameter are know to exist. Dug wells will usually be 15 to 50 feet deep.

Driven-point (sand point) well are constructed be driving assembled lengths of pipe into the ground. These wells are normally smaller in diameter (2 inches or less) and less than 50 feet deep. They can only be installed in areas of relatively loose soils, such as sand.

All other types of wells, including those constructed by a combination of jetting and driving, are drilled wells. Depth will vary depending on the aquifer.

Well depth

Shallow well which draw from the ground water nearest to the land surface are generally more quickly affected by surface activities, such as pesticide usage. Local geologic conditions

determine how long it takes fro this effect to happen. In some places, this process happens quickly— in weeks, days, or even hours. Areas with thin soils over fractured bedrock or sand and gravel aquifers are particularly vulnerable to contamination. On the other hand, thick clay soils can prevent contaminants from reaching the aquifer.

You wouldn't let a car or tractor run too long without an oil change, and likewise your well deserves the same attention. Good maintenance means testing the water every year, keeping the well area clean and accessible, keeping potential contaminants as far away as possible, and periodically having a qualified well driller check the well mechanics.

3. Managing and Maintaining Existing Wells

Better management of your existing well

Existing wells were most likely located according to traditional practice or regulations in place at the time of construction. While these wells may yet be producing potable water, you may want to consider how your well conforms to current standards and recommendations. Current standards can be found in the IDWR Well Construction Standards Rules (http://idwr.idaho.gov/water/well) and in the Idaho Guidelines for Non-Public Drinking Water Wells. Recommendations to better protect your drinking water supply can also be found within the Homestead Assessment System **(Home*A*Syst)** (http://homeasyst.idahoag.us), as well as other publications (refer to the *Contacts and References* section). DEQ's website (http://deq.idaho.gov/water/prog_issues/ground_water/wells/overview.htm) provides an overview for protecting private wells and contains links to the U. S. Environmental Protection Agency (EPA) web site (http://epa.gov/safewater/privatewells/whatyoucando) and to the *Idaho Private Well Owners* brochure (an Idaho Department of Health and Welfare publication).

Some ideas to consider are moving pesticide mixing, tank rinsing, or fuel storage further from your well. You might want to upgrade your well to include removing well pits, installing seals, or extending casings.

Changing the location of other practices may prove expensive (you can't move an animal lot or a silo overnight). Until you can meet minimum separation distances, you might change the way you manage such structures to control contaminants. For example, if your silo is too close to your well, you may want to install a system for collecting any drainage from freshly ensiled forage or install a diversion ditch to direct animal lot runoff away from the well (see Fact/Worksheet 9, *Improving Silage Storage*, for further information).

Provide some short-term manure storage as manure can contaminate your well with bacteria and/or nitrates. Locate storage areas on clay soil or, better yet, a concrete slab to reduce the chance of contaminating your drinking water. Also, protect these storage sites from rain and surface runoff (see Fact/Worksheet 7, *Improving Animal Manure Storage,* for further information).

The other **Home*A*Syst** fact sheets and worksheets provide more information on various potential contamination sources around your homestead. Several management practices you may want to consider to help maintain the quality of your well water include:

- Limit the use of petroleum products, solvents, or lawn and agricultural chemicals near your well.
- Protect wells from wastes stored or disposed of around the homestead.
- Protect wells from household wastewater treatment systems. Consider the possibility

of upgrading or improving management of your current system.

- Move traffic areas and chemical or fuel storage areas away from the well.
- Limit the number of activities and structures located within 100 feet of your drinking water well. Increase this distance if you are working upgradient from your well.
- Inspect your septic system, septic tank, and all other tanks used with the system and drainfield to make sure it's operating properly at least once a year. If you think there are problems, call your local public health district or a licensed septic system repair company.

Backflow prevention and cross connections

Backflow or back-siphoning from pesticide mixing tanks allows chemicals to flow back into the well through the hose. Use an anti-backflow device when filling pesticide sprayer tanks to prevent the chemical mixture from flowing back into the well and contaminating ground water. Inexpensive anti-backflow devices for hoses used to fill farm sprayers may be available from irrigation or spray equipment suppliers. Provide an air gap of at least six inches between the hose and the top of the sprayer tank being filled. As an additional safety factor, pesticides should be added after the tank has been filled.

You may also want to consider purchasing an inexpensive plastic nurse tank. A nurse tank is filled with water at the well and then used to fill the sprayer away from the homestead and away from the well (for more information about preventing well contamination from pesticide mixing and loading practices, see Fact/Worksheet 2, *Pesticide Storage and Handling*).

Anti-backflow devices can be placed on all faucets with hose connections, and air gaps should be maintained between hoses or faucets and the water level during all activities. Otherwise, you risk having contaminated water from laundry tubs, sinks, washing machines, pressure washers, outside hydrants, livestock tanks, and swimming pools flowing back through the plumbing to contaminate your water supply. Water supplies that have cross-connections between them (connections between two otherwise separate pipe systems, such as potable and nonpotable) also put your drinking water at risk. Although not required by state law, your county or city may mandate the use of backflow or back-siphoning prevention devices. Check with your local public health district for additional information.

Water testing

Keep an eye on water quality in existing wells by testing them annually. Although you can't have your water tested for every conceivable contaminant, some basic and inexpensive tests can indicate whether or not other problems exist. At a minimum, test your water annually for bacteria and nitrates using an Idaho certified laboratory. Your local public health district can provide assistance with collecting the sample or finding a laboratory, if needed. A good initial set of tests for a private well includes hardness, alkalinity, pH, conductivity, and chloride. Testing for other constituents may be appropriate depending on the subsurface material the water is drawn through.

The U. S. EPA, under the Safe Drinking Water Act, has established Maximum Contaminant Levels (MCLs) for certain contaminants and requires public water systems to test the water for those contaminants using approved laboratory methods. Non-public systems are not required to conduct the same testing, however, it is good to have your water tested annually to find out if your drinking water exceeds any MCLs.

You may choose to obtain a broad scan for a number of contaminants. Some labs offer a screening for metals, inorganic chemicals, volatile organic chemicals (VOCs), and pesticides. These tests can be expensive, so you will probably not have them done unless you suspect a specific problem.

When testing for additional contaminants, be sure to select contaminants that are most likely present at your homestead. For example: test for lead if you have lead pipes or soldered copper joints; test for VOCs if there has been a nearby use, spill or deposit (in dump or landfill) of oil, petroleum, or solvent.

While testing for pesticides can be very expensive (often $80-$200 per analysis), the expense may be justified if:

- A pesticide spill or back siphoning has occurred near the well.
- Pesticide mixing and loading has occurred near the well.
- Your well has nitrate levels greater than 10 mg/L (reported as nitrate-nitrogen, NO3-N).
- Your well is shallow or is located in sandy soil and down slope from irrigated cropland where pesticides are used.

You can seek further advice on appropriate water tests from your local public health district, Idaho State Department of Agriculture (ISDA), DEQ or IDWR. You should test your water more frequently if:

- There are unexplained illnesses in the family.
- There are individuals who may be at increased risk like infants and pregnant or nursing women.
- There are noticeable changes in livestock or poultry performance.
- Your neighbors find a particular contaminant in their water.
- You note a change in water taste, odor, color, or clarity.
- You have a spill or back siphon of chemicals or petroleum products near your well or on your homestead.
- You or your neighbor apply chemicals or manure to fields within 100 feet of your well.
- Your animal operation inspectors require it.

You can have your water tested by a commercial laboratory. A list of Idaho certified labs is available from DEQ (http://www.deq.state.id.us/water/assist_business/pws/labs_certified.xls) or your local public health district. Follow the lab's instructions for water sampling to assure accuracy of the results. Use only the container provided and return samples promptly. Bacteria sample bottles are sterile and must be returned to the lab

within specified time limits. **Request that drinking water methods be used to test your water.**

Because many materials, including bacteria and nitrate-nitrogen, naturally occur in minor amounts in ground water and levels can vary seasonally, you may want to contact a specialist for help in interpreting test results. Contact your local public health district or DEQ office in your area for assistance. Several Cooperative Extension System and DEQ publications may be of help as well (see *Contacts and References* section).

Nitrate and bacteria are acute contaminants, which means that the health effects are more immediately felt. Nitrate levels greater than 10 mg/L should not be consumed by infants under one year of age. The standard bacteriological test conducted on drinking water supplies is the test for total coliforms. If any bacteria are detected in a water system, re-sample the system. If a presence is confirmed by the second test, well owners should take action to correct the problem, i.e., disinfection. The presence of total coliforms is an indicator of system vulnerability. If a presence is detected in any bacterial analysis, the lab will automatically test for the presence of fecal coliforms.

The presence of fecal coliforms is a more serious matter since it indicates that the well is vulnerable to contamination by fecal material and may also contain other pathogens as well. There is no acceptable level for fecal coliform contamination. If fecal coliforms are present, the water does not meet drinking water standards and is unsafe to drink.

Keep in mind that activities off of your property can also affect your ground water, since ground water moves. Chemical spills, changes in land use, underground storage tanks, and the presence of landfills can increase the chance of contaminants getting into your water. Bacteria and nitrates are two important indicators which may suggest problems with the well's location or construction, and at excessive levels, can cause health problems. If your water has a high nitrate or bacteria level, you may want to talk with a specialist about the need for additional testing, disinfection, or other treatment.

It is also important to record test results and to note changes in water quality over time. In addition to water analysis test results, you should keep records of a few other things. These include well construction details, results of maintenance for the well and pump, and dates that these activities are done.

It is important to mention that it is possible over-chlorinate a well. If chlorine is poured down a well on a regular basis to disinfect the water, eventually it can damage the pump and/or the casing. Adding chlorine directly to a well is only advised during a "shock disinfection". If a homeowner prefers regular addition of chlorine, they are advised to get chlorine injection pump that adds the chlorine into a distribution pipe.

Well maintenance

Well equipment doesn't last forever. From time to time, your well may require attention to its mechanical parts. Well maintenance also includes protecting your well from contamination sources.

4. New Wells

New wells are expensive, but they are a good investment for the future. Getting the most from such an investment means locating the well away from contamination sources and working to maintain the quality of the well. Some simple principles are:

- Follow at least the required minimum distances from potential contamination sources that are set by your local public health district, as well as any other local ordinances, when locating your new well (see *Contacts and References* section).
- Locate your well on ground higher than contamination sources such as fuel tanks, livestock lots, septic systems, or pesticide mixing areas. Where practical, locate the well as far as possible from contamination sources.
- Build soil up around the well so that all surface water drains away from it, but maintain the minimum 12 inches of casing above the soil surface.
- Avoid areas that are prone to flooding.
- Make the well accessible for pump repair, cleaning, testing, and inspection.
- Hire a competent, licensed well driller. Make sure the driller disinfects the well with chlorine after construction, tests the water for bacteria after drilling, and provides a copy of the water well record, which includes detailed information about the well depth and construction.

5. Unused Wells

Many rural homesteads have unused wells. It is not uncommon to visit a homestead and find three or four wells, with only one or two currently in use. No one knows how many of these wells are in Idaho, although estimates range in the thousands.

If not properly filled and sealed, these wells can provide a direct conduit for surface water carrying contaminants to enter ground water without filtering through soil or can allow contaminant movement from one aquifer to another.

In addition to these wells being a threat to ground water, large open wells pose safety hazards for people and animals. The landowner, under Idaho law, is responsible for properly abandoning wells and test holes.

You may perform proper well abandonment work on your own land or an Idaho licensed well driller can also be hired to close these wells. Regardless of who does the work, the minimum regulatory requirements must be met. A local well driller can be helpful because they will have experience with well construction materials and methods as well as a working knowledge of the geology of the well site. In addition, special equipment is often required to remove old pumps and piping and to properly install sealing material inside the well. Use of inappropriate materials and methods can lead to well settling, collapse, and continued ground water contamination.

Locating unused wells

Pipes sticking out of the ground around the homestead or under an old windmill are the most obvious places for finding unused wells. You may not know the history of your property, however, and old well locations may not be obvious. A depression in the ground may indicate an old well. Also, wells were often drilled in basements of houses, under front steps, or near old cisterns.

Proper well abandonment

The IDWR administers the laws regulating the abandonment of wells. Well drillers and landowners are required to follow these laws so that the potential for aquifer contamination can be reduced.

Proper well closing takes time and money. Costs will vary with the well depth, diameter, and geology of the area. However, spending a few hundred dollars to properly abandon an old well near your home may prevent contamination of your drinking water. Please contact the IDWR regional office in your area for additional information.

Contacts and References

Who to contact about...

Certified water testing laboratories

• Ask a water testing laboratory if they are certified for drinking water testing or call the Laboratory Certification Officer, Department of Health and Welfare, Bureau of Laboratories, (208) 334-2235 for a listing, or the DEQ Idaho Drinking Water Program, (208) 334-5860.

Interpreting well water test results, installation of home water conditioning and treatment devices

• Call your local public health districts or county Cooperative Extension System offices.

• Public Health Districts:

Boise	(208) 375-5211	Caldwell	(208) 455-5300
Coeur d'Alene	(208) 664-8736	Idaho Falls	(208) 522-0311
Lewiston	(208) 799-3100	Pocatello	(208) 233-9080
Twin Falls	(208) 734-5900	Blackfoot	(208) 785-2160
Gooding	(208) 934-4477	Sandpoint	(208) 263-5159

Federal drinking water quality standards and other drinking water concerns

• U.S. Environmental Protection Agency's Safe Drinking Water Hotline: call toll free (800) 426-4791 from 6:30 a.m. to 3 p.m. Mountain Standard Time.

Locating possible sources of contamination

• Call your local public health district, county Cooperative Extension System office, a licensed well driller, or the DEQ office for your area. Besides locating contamination sources, they can also recommend improvements to decrease contamination potential.

• Idaho Department of Environmental Quality, regional offices:

North (Coeur d'Alene):	(208) 769-1422
North Central (Lewiston):	(208) 799-4370
Southwest (Boise):	(208) 373-0550
South Central (Twin Falls):	(208) 736-2190
Southeast (Pocatello):	(208) 236-6160
Eastern (Idaho Falls):	(208) 528-2650

• Idaho State Department of Agriculture, Water Section:

State Office (Boise):	(208)332-8603

Well construction or inspection, and abandonment of unused wells

• Contact the Idaho Department of Water Resources (208) 327-7900 for referrals of licensed well drillers in your area.

A copy of your well construction record

If a report was filed with the state, it will be on file at the IDWR office for your area. Be

prepared to provide the legal description (***county, township, range, section (1/4 of a 1/4 sec. or 40 acres***) of the well's location (***If your property covers more than one section, make a note of that in case well drillers reported the wrong section***). If known, provide the year the well was installed and the owner's name at the time the well was drilled.

What to read about...

General ground water

- *Ground Water and Wells, 2nd Edition;* Driscoll, Fletcher G. PhD., Johnson Filtration Systems, Inc., St. Paul, Mn. 55112, 1989.
- *Groundwater: Understanding Our Hidden Resources,* The Freshwater Foundation, 2500 Shadywood Road, Box 90, Navarre, Mn. (612) 471-7467.
- Project WET (Water Education for Teachers), *Groundwater flow model,* manual, Idaho Water Resources Research Institute, 106 Morrill Hall, University of Idaho, Moscow, ID. (208) 885-6429.
- *Wellhead Protection in Idaho* (workshop manual), Idaho Division of Environmental Quality (208) 334-5860, Idaho Water Resources Research Institute (208) 885-6429.
- *Well Construction Standards,* Rules, Administrative Rules of the Idaho Water Resources Board, State of Idaho, IDWR, 1989.
- *Guidelines for Non-Public Drinking Water Wells,* November, 1987.

Ground water contamination and protection

- *Citizen's Guide to Ground Water Protection, April 1990, U. S. EPA, EPA 440/6-90-004.*
- *Power to Protect, Three Stories about Ground Water* (video), U.S. EPA, Massachuesetts Audubon Society, New England Interstate Water Pollution Control Commission (Video canbe borrowed from your Idaho Department of Environmental Quality, Regional Office).
- *Protecting Ground Water Quality in Idaho* (brochure), Idaho Department of Environmental Quality.
- *Wellhead Protection, A Decision Maker's Guide,* May 1987, U.S. EPA.

General water testing

- *Water Testing,* University of Idaho, Cooperative Extension System, Current Information Series No. 873.

Publications available from...

• Cooperative Extension System publications are available from your local county Cooperative Extension System office or the University of Idaho, Agricultural Publications, Idaho Street, Moscow, ID. 83844-2240, (208) 885-7982. There may be charges for publications, postage, and sales tax.