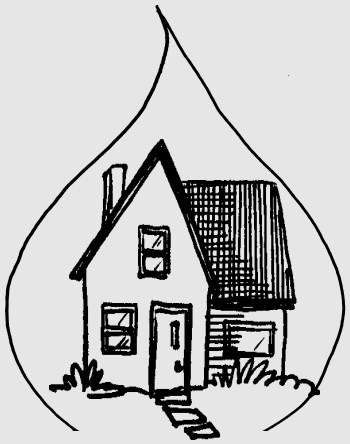

Keeping your well water free of harmful contaminants is a top priority -- for your health and for the environment. This assessment helps you examine how you manage your well, and how activities on or near your property may affect water quality. This assessment covers:

1. Well location
How close is your well to potential pollution sources? How might your soil type affect water safety?

2. Well construction
Do you know the age of your well and how it was installed? Is your well casing properly sealed?

3. Water testing and unused wells
Have tests of your well water revealed any problems? Are abandoned wells protected against contamination?

Home*A*Syst

for New Jersey

Drinking Water Well Management

Why should I be concerned?

Nationwide, about 95% of rural residents use private wells to supply their drinking water. In New Jersey, about 15% of residents have private drinking water wells. These wells, which tap into local groundwater, are designed to provide clean, safe drinking water. However, improperly constructed or poorly maintained wells can create a pathway that allows disease causing bacteria, viruses, fertilizers, pesticides, or other harmful chemicals to contaminate the water supply. These contaminants, which often have no taste, odor or color, can put your health at risk. Once in groundwater, contaminants can flow from beneath your property to a neighbor's well, or from beneath a neighbor's property to *your* well.

Many tests may be required to analyze for bacteria, fertilizers, pesticides, and other contaminants. Once detected, certain contaminants are difficult and expensive to remove. The only options may be to treat the water after pumping, drill a new well, or obtain water from another source.

How will this worksheet help me protect my drinking water and home environment?

This worksheet is a guide to help you better understand the condition of your well and how you take care of it. Easy-to-understand risk assessments help you identify situations and practices that are safe as well as ones that may require prompt attention. Additional information on how to safeguard all water sources may be obtained from your local health department, your local office of Rutgers Cooperative Extension, your local Soil Conservation District staff, New Jersey Department of Environmental Protection's Bureau of Safe Drinking Water, New Jersey Department of Health, and the library.

Part 1 -- Well Location

Your well's location in relation to other features on or near your property will determine part of your potential pollution risks. Proximity to sources of pollution, and whether the well is uphill or downhill from those sources are the primary con-

cerns. At the end of Part 1, fill out the assessment table to determine your possible well-location risks. The information below will help you answer the questions in the assessment.

What pollution sources might reach your well?

Whether groundwater is just below the surface or hundreds of feet down, the location of your well on the land surface is very important. Installing a well in a safe place takes careful planning and consideration. Where the well is located in relation to potential pollution sources is a critical factor.

When possible, the well should be located where surface water (storm runoff, for example) drains away from it. If a well is downhill from a leaking fuel storage tank, septic system, or overfertilized farm field, it runs a greater risk of contamination than a well on the uphill side of these pollution sources. In areas where the water table is near the surface, groundwater often flows in the same direction as surface water. Surface slope, however, does not always indicate the direction a pollutant might flow once it gets into groundwater. Changing the location or depth of your well may protect your water supply, but not the groundwater itself. Any condition likely to cause groundwater contamination should be eliminated, even if your well is far removed from the potential source.

Does your well meet separation-distance requirements?

New Jersey requires that new wells be located a minimum distance from sources of potential pollution. For example, new wells must be 50 feet from a septic tank, 100 feet from a septic system disposal field, and 150 feet from a cesspool. When no distances are specified by state or local law, provide as much separation as possible between your well and any potential contamination source -- the further away the better. Separating your well from a contamination source may reduce

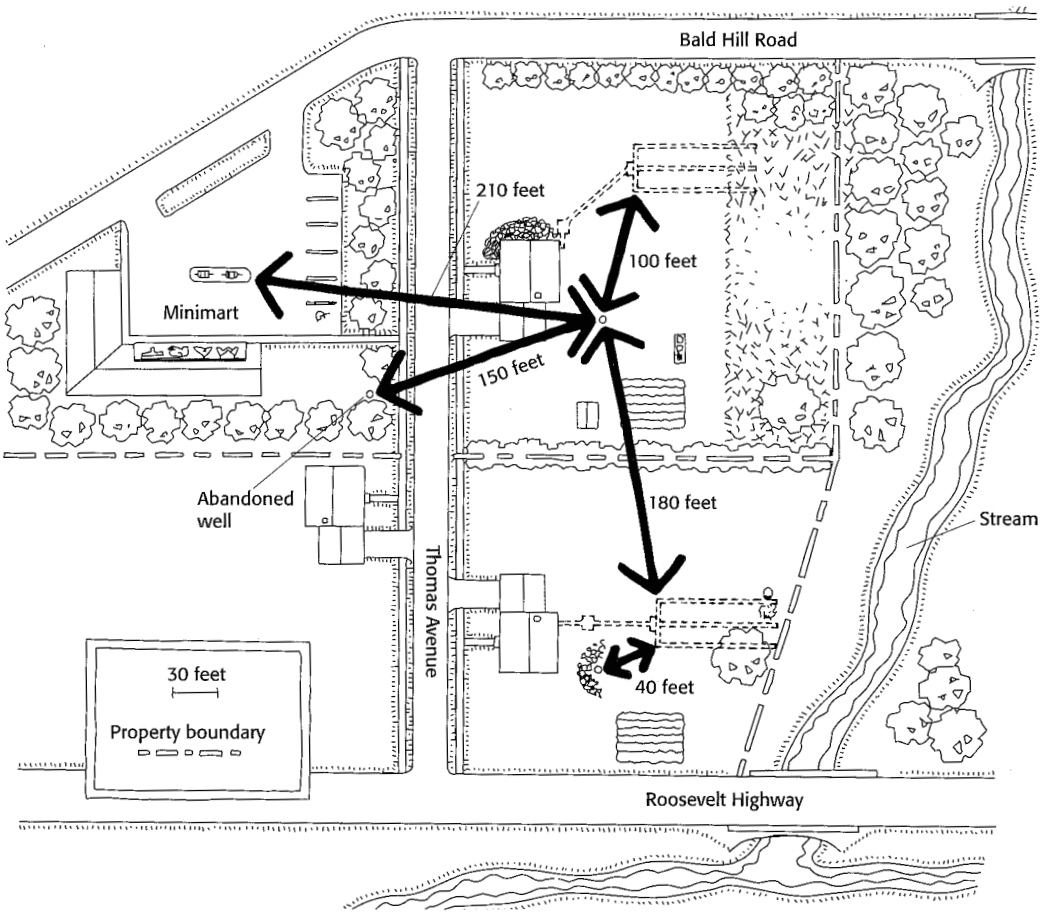

Figure 1. Map showing distances of pollution sources from well.

the risk but it does not guarantee that the well will be safe.

What's underground -- soil and bedrock type, distance to the water table?

Pollutant risks are greater when the water table is near the surface because contaminants do not have to travel far. Contamination is more likely if soils are thin (a few feet above bedrock) or if they are highly porous (sandy or gravelly). If bedrock below the soil is fractured --if it has many cracks which allow water to seep down rapidly -- then groundwater contamination is more likely. Check with neighbors, local farmers, your local Soil Conservation District, well drilling companies, or well records at your local health department to learn more about what's under your property. If your municipality has a Natural Resource Inventory as part of their Master Plan, you may find information there about soils and groundwater.

Assessment 1 -- Risks Related to Well Location

Use the table below to rate your well location risks. For each question, put the risk-level number (1,2 or 3) in the column labeled "Your Risk." Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 1 above if you need more information to complete the table.

Responding to Risks

Your goal is to lower your risks. Turn to the Action Checklist on the page 35 to record the medium and high risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

ASSESSMENT 1 -- Risks Related to Well Location

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Position of well in relation to pollution sources	Well is uphill from all pollution sources. Surface water doesn't reach well or is diverted.	Well level with or uphill from most pollution sources. Some surface water runoff may reach well.	Well located downhill from pollution sources or in a pit or depression. Surface water runoff reaches well.	
Separation distances between wells and pollution sources	Meets or exceeds all state minimum separation distances.	Meets minimum distance requirements for some, but not all, pollution sources.	Does not meet minimum separation distances for most or all potential sources.	
Soil type	Fine-textured soils, such as clay loam and silty clay.	Medium- or coarse-textured soils.	Coarse-textured soils such as sands and sandy loams.	
Subsurface conditions	Water table or fractured bedrock deeper than 40 feet.	Water table or fractured bedrock deeper than 20 feet.	Water table or fractured bedrock shallower than 20 feet.	

Part 2 -- Well Construction and Maintenance

Old or poorly designed wells increase the risk of groundwater contamination by allowing rain or snowmelt to reach the water table without being filtered through soil. If a well is located in a depression or pit, or is not properly sealed and capped, surface water carrying nitrates, bacteria, pesticides, feritilizers, and other pollutants may flow directly into your drinking water.

You wouldn't let a car go too long without a tune-up or oil change. Your well deserves the same attention. Good maintenance means keeping the well area clean and accessible, keeping pollutants as far away as possible, and periodically having a qualified well driller or pump installer check the well when problems are suspected. At the end of Part 2, fill out the assessment table to determine risks related to well design or condition.

How old is your well?

Well age is an important factor in predicting the likelihood of contamination. Wells constructed more than 70 years ago are likely to be shallow and poorly constructed. Older well pumps are more likely to leak lubricating oils, which can get into the water. Older wells are also more likely to have thinner casings which may be cracked or corroded. Even wells with modern casings that are 30 to 40 years old are subject to corrosion and perforation. If you have an older well, you may want to have it inspected by a qualified well driller.

What type of well do you have?

A **dug well** is a large diameter hole, usually more than two feet wide, and often constructed by hand. Dug wells are usually shallow and poorly protected from surface water runoff. **Driven-point (sand point) wells**, which pose a moderate to high risk, are constructed by driving lengths of pipe into the ground. These wells are normally around two inches in diameter and less than 50 feet deep and can only be installed in areas with loose soils such as sand. All other types of wells are **drilled wells** which, for residential use, are commonly four to eight inches in diameter. New dug wells and driven-point wells are **NOT ALLOWED** under New Jersey regulations. All new drilled wells are required to be drilled by a licensed well driller.

Are your well casing and well cap protecting your water?

Well drillers install a steel or plastic pipe "casing" to prevent collapse of the hole during drilling. The space between the casing and sides of the hole offers a direct channel for

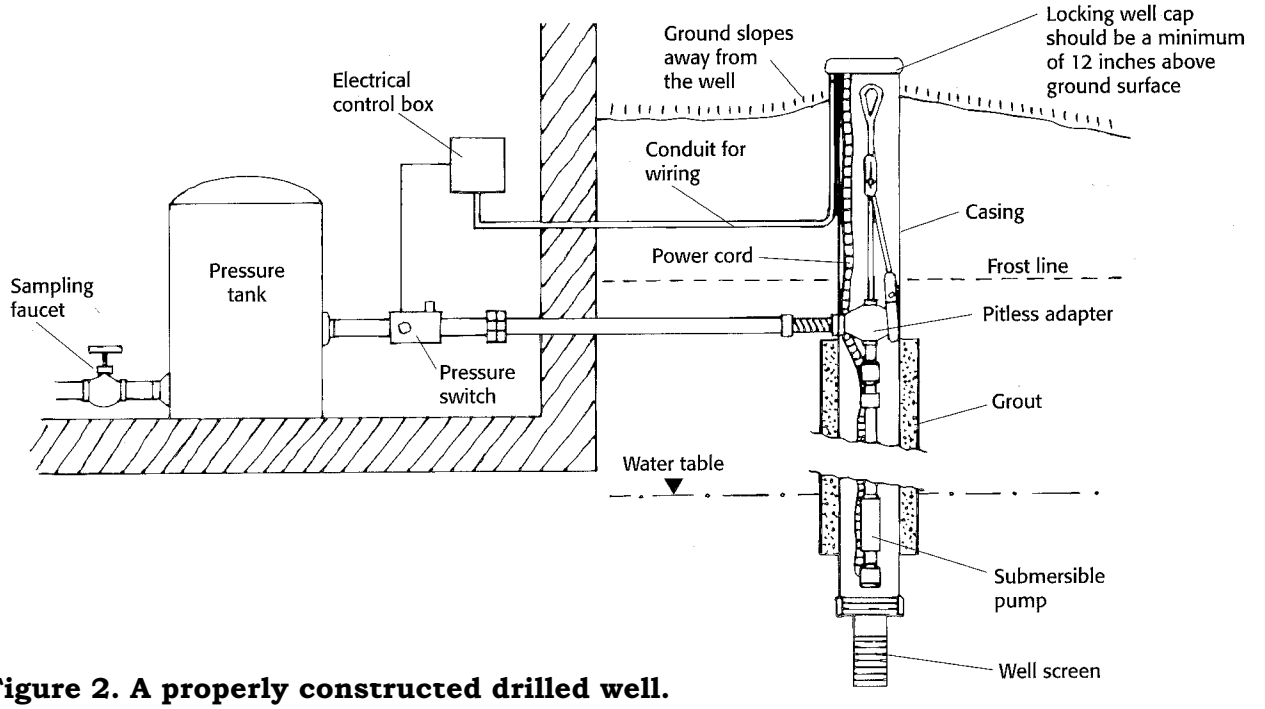

Figure 2. A properly constructed drilled well.

surface water -- and pollutants -- to reach the water table. To seal off that channel, drillers fill the space with grout (cement or a special type of clay called bentonite).

You should visually inspect the condition of your well casing for holes or cracks. Examine the part that extends from the ground as well as inside the casing, using a flashlight. If you can move the casing around by pushing it, you may have a problem with your well casing's ability to keep out contaminants. Sometimes, damaged casings can be detected by listening for water running down into the well when the pump is not running. If you hear water, there might be a crack or hole in the casing, or your casing may not reach down to the water table. Either situation is risky.

The depth of casing required for your well depends on the depth to groundwater and the nature of the soils and bedrock below. In sandy and gravelly soils, well casings should extend to a depth of at least 50 feet.

Typically, the well casing extends one to two feet above the surrounding land, preventing surface water from running down the casing or on top of the well cap and into the well. New Jersey regulations require that at least 12 inches of casing pipe extend above the final grade of the land. The ground around the casing should slope away from the wellhead in all directions to prevent water from pooling around the casing.

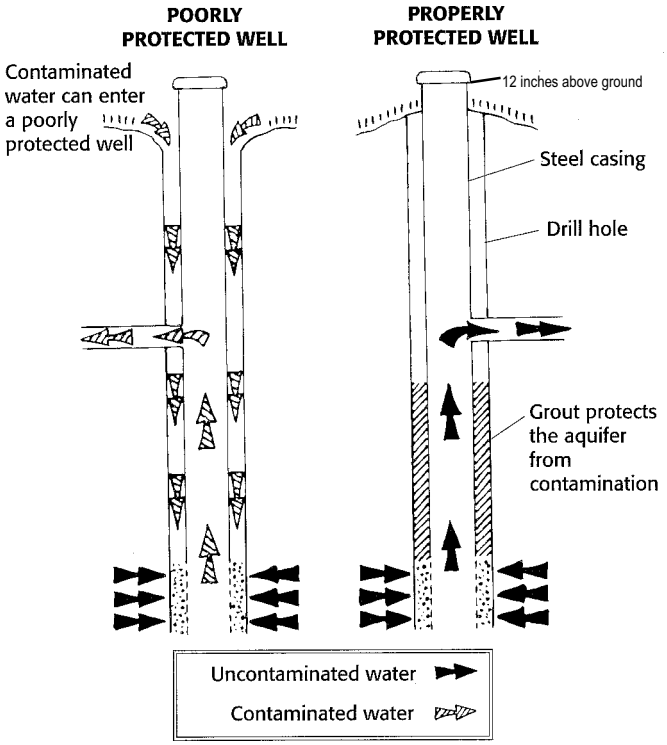

Figure 3. A poorly protected well versus a properly protected well.

The well cap should be firmly attached to the casing, with a screened vent allowing only air to enter. Wiring for the pump should be secured in an electric conduit pipe. If your well has a vent, be sure that it faces the ground, is tightly connected to the well cap or seal, and is properly screened to keep insects out.

Is your well shallow or deep?

As rain and surface water soak into the soil, they may carry pollutants down to the water table. In some places, this process happens quickly -- in weeks, days or even hours. Local geologic conditions determine how long this takes. Shallow wells, which draw from groundwater nearest the land surface, are most likely to be affected by local sources of contamination.

Do you take measures to prevent backflow?

Backflow of contaminated water into your water supply can occur if your system undergoes sudden pressure loss. Pressure loss can occur if the well fails or, if you are on a public water system, if there is a line break in the system. The simplest way to guard against backflow is to leave an air gap between the water supply line and any reservoir of "dirty water." For example, is you are filling a swimming pool with a hose, make sure that you leave an air gap between the hose and the water in the pool. Toilets and washing machines have built-in air gaps.

Where an air gap cannot be maintained, a backflow prevention device, such as a check valve or a vacuum breaker, should be installed on the water supply lines. For example, if you are using a pesticide sprayer that attaches directly to a hose, a check valve should be installed on the faucet to which the hose is connected. Inexpensive backflow prevention devices can be purchased from plumbing suppliers.

ASSESSMENT 2 -- Risks Related to Well Type and Condition

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Well age	Less than 20 years old.	20 to 70 years old.	More than 70 years old.	
Well type	Drilled well.	Driven point well.	Dug well.	
Casing height above land surface	More than 12 inches above the surface.	At the surface or up to 8 inches above.	Casing below surface or in a pit or basement.	
Condition of casing and well cap	No holes or cracks. Cap tightly attached. Screened vent.	No holes or cracks. Cap loose.	Holes or cracks visible. Cap loose or missing. Running water can be heard.	
Casing depth	Casing extends more than 100 feet below water level.	Casing extends 15 to 100 feet below water level.	Casing extends less than 15 feet below water level.	
Backflow protection	Anti-backflow devices (such as check valves) installed on faucets with hose connections. No cross-connections between water uses.	No anti-backflow devices.	No anti-backflow devices. Cross-connections between water supplies.	
Well inspection and "tune-up"	Well was inspected within the last 10 years.	Well was inspected 10 to 20 years ago.	I don't know when well was last inspected or it was inspected over 20 years ago.	

How long since your well was inspected?

Well equipment doesn't last forever. Every 10 to 20 years, your well will require mechanical attention from a qualified well driller or pump installer. In addition to annual water test results, you should keep well construction details, as well as the dates and results of maintenance visits for the well and pump. It is important to keep good records so you and future owners can follow a good maintenance schedule.

Assessment 2 -- Risks Related to Well Type and Condition

Use the above table to rate your risks related to well type, well casing, and backflow. For each question, put the risk-level number (1,2 or 3) in the column labeled "Your Risk." Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 2 above if you need more information to complete the table.

Responding to Risks

Your goal is to lower your risks. Turn to the Action Checklist on page 35 to record the medium and high risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

Part 3 -- Water Testing and Unused Wells

Water testing helps you monitor water quality and identify potential risks to your health. Contaminants may enter drinking water from many sources. Many contaminants can only be detected through a water test.

Abandoned wells, if improperly sealed, can provide a direct route for contaminants to enter groundwater. It is important to identify old or abandoned wells and determine appropriate action. At the end of Part 3, fill out the assessment table to determine water quality risks related to water contaminants and old wells.

Are there any unused and abandoned wells on your property?

Many properties have wells that are no longer used. Sites with older homes often have an abandoned shallow well which was installed when the house was first built. If not properly filled and sealed, these wells can provide a direct channel for water-borne pollutants to reach groundwater.

New Jersey laws require property owners to seal wells upon abandonment. A licensed, registered well driller or pump installer should be hired to close these wells. Effective well-plugging calls for experience with well construction materials and methods, as well as knowledge of the geology of the site. Costs will vary with well depth, diameter, and soil/rock type. The money spent sealing a well will be a bargain compared to the potential costs of cleanup or the loss of property value if contamination occurs.

When was your water last tested?

At a minimum, your water should be tested *each year* for the three most common indicators of trouble: bacteria, lead, and nitrates. If you haven't had a full-spectrum, comprehensive, water test, then you don't know the basic characteristics of your water. A more complete water analysis for a private well will tell you about its hardness, pH, corrosivity, radioactivity and iron, sodium, manganese, mercury, and chloride content. In addition, you may choose to obtain a broad scan test of your water quality for other contaminants such as pesticides and volatile organic chemicals. A good source of information may be your neighbors. Ask them what their tests have revealed.

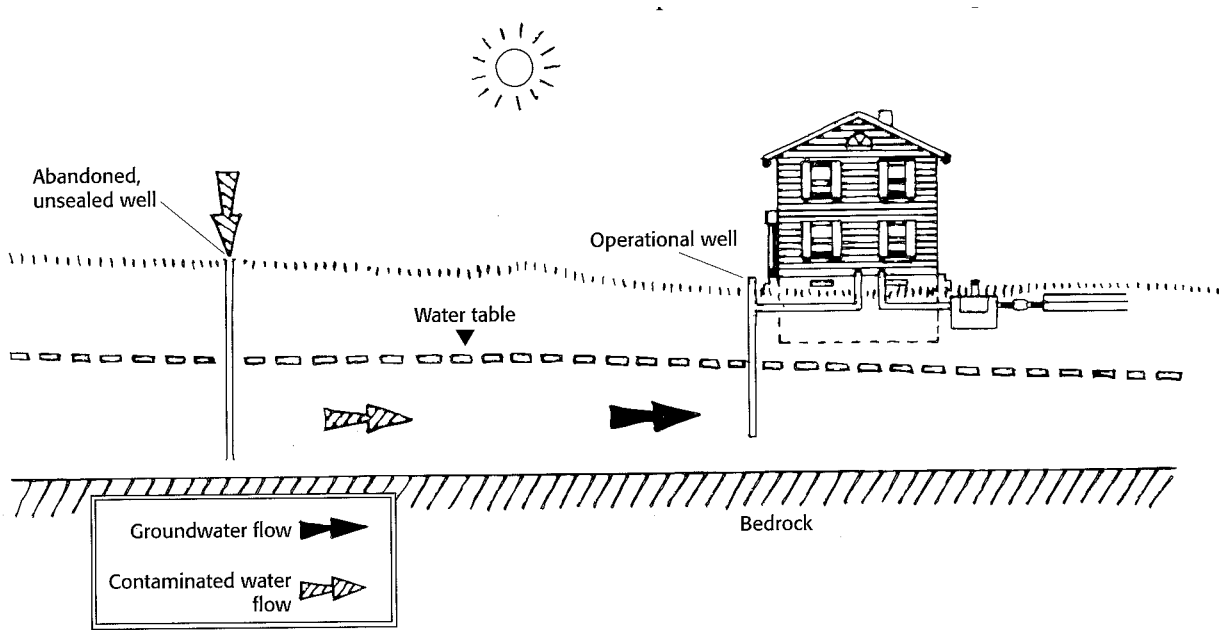

Figure 4. Abandoned wells that are not properly sealed provide a pathway for contaminants to reach groundwater.

Some New Jersey residents may be required by their county or municipal Board of Health to test for additional contaminants before final certification of new wells and upon sale or transfer of ownership of property where a well is located.

What contaminants should you look for?

Test for the contaminants that might be found at your location. For example, if you have lead pipes, soldered copper joints or brass parts in the pump, test for the presence of lead (see the Home-A-Syst worksheet "Lead in and Around the Home" for more information). Test for volatile organic chemicals (VOCs) if there has been a use or spill of oil, liquid fuels or solvents in your area.

Pesticide tests, though expensive, may be justified if your well has high nitrate levels -- more than 10 milligrams per liter (mg/l) of nitrate-nitrogen (NO_3N), or 45 mg/l of nitrate (NO_3). Test also if a pesticide spill has occurred near the well. Pesticides are more likely to be a problem if your well is shallow, has less than 15 feet of casing below the water table, or is located in sandy soil and is downslope from irrigated lands where pesticides are used.

You can seek further advice on testing from your local health department or your county office of Rutgers Cooperative Extension. You should test your water more than once a year if 1) someone is pregnant or nursing, 2) there are unexplained illnesses in the family, 3) your neighbors find a dangerous contaminant in their water, 4) you note a change in water taste, odor, color or clarity, or 5) you have a spill or backsiphonage of chemicals or fuels into or near your well. Request Fact Sheet 343 *Where to Get Your Drinking Water Tested in New Jersey* from your county Cooperative Extension Office for a list of state certified water testing laboratories. For a list of federal and state drinking water standards, request Fact Sheet *433 Drinking Water Standards*. Once tested, keep a record of your results to monitor water quality over time.

Assessment 3 -- Water Testing and Abandoned Wells

Use the table below to rate your risks related to water quality and unused wells. For each question, put the risk-level number (1,2 or 3) in the column labeled "Your Risk." Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 3 above if you need more information to complete the table.

ASSESSMENT 3 -- Water Testing and Abandoned Wells

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Water testing	Consistent good water quality. Tests do not detect presence of bacteria, nitrate or other contaminants.	Some tests detect contaminants, but below standards.	Some tests do not meet standards. No water testing done. Water discolored after a rainstorm. Noticeable changes in color, odor, and taste.	
Unused wells	Unused well is properly sealed.	Unused well is not sealed, but is capped and isolated from contaminants.	Unused, uncapped, unsealed well in poor condition located near pollution sources.	

Responding to Risks

Your goal is to lower your risks. Use the Action Checklist below to record the medium and high risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

ACTION CHECKLIST

When you finish the assessment tables, go back over the questions and list below every high and medium risks you identified. For each of these risks, write down the improvements you plan to make. Use recommendations from this worksheet and from resources elsewhere. Pick a target date that will keep you on schedule for making the changes. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Write all high and medium risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Water hasn't been tested for 10 years. Smells different than it used to.	Have sample tested at a certified testing lab.	One week from today.

FOR MORE INFORMATION...

Who to contact for help or more information about wells

Water testing. Request the following fact sheets from your county office of Rutgers Cooperative Extension:

FS 343 *Where to Get Your Drinking Water Tested in New Jersey*
FS 433 *Drinking Water Standards*
FS 434 *Drinking Water: What Tests Do I Need?*
FS 435 *Drinking Water Treatment and Conditioning*
E 214 *Interpreting Drinking Water Quality Analysis ($2.00)*

Drilling & sealing wells. Contact your local health department, local plumbers, well drillers (in the yellow pages of your phone book), or contact New Jersey Department of Environmental Protection's Bureau of Water Allocation at (609) 292-2957.

Groundwater, soil type & geology. Contact the New Jersey or U.S. Geological Survey or your county Soil Conservation District.

For basic information on groundwater resources, request *What is Groundwater* from New Jersey Department of Environmental Protection's Office of Environmental Planning at (609) 633-1179.

Drinking water quality standards. Call the U. S. Environmental Protection Agency's (EPA) Safe Drinking Water Hotline, toll free (800) 426-4791 from 8:30 a.m. to 5:00 p.m. for unique or unusual situations. For many water contaminants, New Jersey has its own, stricter standards. Request E 214 *Interpreting Drinking Water Quality Analysis ($2.00)* from your county office of Rutgers Cooperative Extension for a detailed explanation. New Jersey Department of Environmental Protection's Bureau of Safe Drinking Water (609-292-5550) has records of testing results for all public water systems in New Jersey.

This Home*A*Syst assessment does not cover all potential risks related to drinking water wells which could affect health or environmental quality. There are other worksheets available on a variety of topics to help homeowners examine and address their most important environmental concerns.

This worksheet was written by Bill McGowan, University of Delaware Cooperative Extension.

This worksheet was adapted for use in New Jersey and technical review provided by Sandy Krietzman, Bureau of Safe Drinking Water, NJDEP; Robert Ingenito, Ocean County Health Department, Susan Lance, Program Associate in Water Quality, Rutgers Cooperative Extension; Theodore B. Shelton, Ph.D. Extension Specialist in Water Resources Management, Rutgers Cooperative Extension; and Jan Larson, Program Associate in Natural Resource Management.