

## *Water Well Condition and Construction*

### WHY BE CONCERNED?

About 80% of Pennsylvania's rural residents use groundwater to supply their drinking water and farmstead needs. Wells are designed to provide clean water. If they are not properly constructed or maintained, groundwater may become contaminated with bacteria, nitrates, and pesticides. These contaminants put family and livestock health at risk.

Abandoned wells are especially significant sources of groundwater contamination. If an abandoned well exists on a farmstead, the landowner is responsible for protecting the groundwater by properly sealing or filling the well (Pennsylvania Public Law 1840, Act 610).

Preventing groundwater contamination is very important. Once groundwater is contaminated, it is very difficult to clean up. Limited cleanup options include treating the water, drilling a new well, and obtaining water from another source. Contamination of a well can affect neighboring wells, posing a serious health risk to farm families, livestock, and neighbors.

**The goal of Pennsylvania Farm•A•Syst is to help you protect groundwater and surface water, shared resources which are important to everyone.**

### HOW TO RANK GROUNDWATER AND SURFACE WATER PROTECTION USING THIS WORKSHEET

- You can select from a wide range of drinking water well conditions and management practices that are related to potential groundwater contamination.
- You can rank your drinking water well conditions and management practices according to how they might affect groundwater.
- Based on your overall ratings, you can determine which of your conditions or practices are reasonably safe and effective, and which might require modification to better protect groundwater.

### HOW TO COMPLETE THE WORKSHEET

Follow the directions on page 2 of the worksheet. It should take 15 to 30 minutes to complete the evaluation and determine your ranking. Evaluate each well that is part of the farmstead. There are spaces provided to rank up to three sites on your farmstead. If you have more than three sites, please use another worksheet. If you are unfamiliar with any of the terms used, refer to the glossary provided with this worksheet.

Information derived from Pennsylvania Farm•A•Syst worksheets is intended only to provide general information and recommendations to farmers regarding their own farmstead practices. It is not the intent of this educational program to keep records of individual results. However, they may be shared with others who will help you develop a resource management plan.

# WORKSHEET #1: WELL CONDITION AND CONSTRUCTION

Use a pencil, in case you want to change an answer later. For each feature listed on the left that is appropriate for your farmstead, read across to the right and circle the statement that most closely describes conditions on your farmstead. Leave blank any features that don't apply to your farmstead. Find your corresponding "rank number" (4, 3, 2, 1) for each description you circled and enter that number in the blank under "your

rank." If the conditions and practices in any one description do not match your situation exactly, use an in-between score of one-half unit; for example, 2.5 or 3.5. Directions on overall scoring appear at the end of the worksheet. Allow 15 to 30 minutes to complete the worksheet and to determine the level of groundwater and surface water protection you are providing.

## MANAGEMENT OF SITE CONDITIONS

	4 Best	3 Good	2 Fair	1 Poor	RANK (up to 3 wells)
<b>LOCATION OF WELL</b>					<b>Site Identification</b>
					<b>#1   #2   #3</b>
<b>1. Type of well</b>	Off-site private or municipal source (therefore site conditions or management practices do not affect your well quality).	Drilled well.	Driven well.	Dug well (has the potential for the most pollutants to enter into the water flow).	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>2. Position of water well in relation to potential sources of contamination</b>	Upslope from all sources of contamination, and all surface water is diverted away from well. <sup>a</sup>	Downhill from sources of contamination, and surface water runoff is diverted from casing.	Downslope from most sources of contamination, and some surface water runoff reaches well.	Well is located in a depression. Ponding occurs around the well during storms.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>3. Distance between well and potential sources of contamination</b>	More than 300 feet from a contamination source.	150-300 feet from a contamination source.	75-150 feet from a contamination source.	Less than 75 feet from a contamination source.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

<sup>a</sup> Sources of contamination include septic system absorption areas, pesticide and fertilizer handling areas, barnyards, and other similar areas.

Site Identification #1. \_\_\_\_\_

#2. \_\_\_\_\_

#3. \_\_\_\_\_

	4 Best	3 Good	2 Fair	1 Poor	RANK (up to 3 wells)
<b>CONDITION OF WELL</b>					<b>Site Identification</b> #1 #2 #3
<b>4. Condition of casing and well cap</b>	Casing and cap are in good condition, with no visible defects. Cap secured tightly.	_____	_____	Holes or cracks visible. Cap loose or missing.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>5. Type and condition of well-sealing materials at ground level or in well pit <sup>a</sup></b>	Space outside casing filled with water-tight cement grout or puddled clay from just below the frost line to the bottom of the casing to prevent entry of contaminated water.	_____	_____	No sealant of any type. <sup>b</sup>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>6. Casing depth <sup>a</sup></b>	Greater than 25 feet deep, and extending through a confining layer or into bedrock.	Greater than 25 feet deep, but not extending through a confining layer.	10-25 feet deep.	Less than 10 feet deep. <sup>b</sup>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>7. Casing height above ground level <sup>a</sup></b>	More than 12 inches.	8-12 inches.	At grade.	Below grade.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>8. Age of well</b>	Less than 20 years.	20-40 years.	40-60 years.	Greater than 60 years.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>9. Backflow prevention</b>	Anti-backflow devices installed on all faucets with hose connections. No cross connections between water supplies.	Anti-backflow devices installed on some faucets with hose connections. Air gap maintained.	No anti-backflow devices. Air gap maintained.	No anti-backflow devices. No air gap maintained. Cross connections occur.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>10. Unused or abandoned wells</b>	No abandoned, unsealed wells.	Abandoned wells are sealed or filled by landowner.	Abandoned, unsealed wells are not capped or protected. <sup>c</sup>	Abandoned, unsealed, dug wells. <sup>c</sup>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

<sup>a</sup> If your well was drilled in 1966 or later, well drilling records may be available if you know the year the well was drilled and who owned or developed the land when the well was drilled. Contact the Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geological Survey for more information.

<sup>b</sup> This practice violates the Pasteurized Milk Ordinance, Appendix D.

<sup>c</sup> This practice violates the P.L. 1840, Act 610

**TOTAL**

Use this total to calculate overall performance ranking.

---

## HOW TO USE THESE RANKINGS

- Step 1.** Now that each feature has been ranked, add all these rankings together and put that value in the "Total" box at the end of the worksheet. Transfer that number to the box below.
- Step 2.** Divide the value in the "Total" box by the number of features ranked.
- Step 3.** Repeat for each additional site. Calculate the average ranking for all sites combined.

_____	divided by	_____	equals	_____
(total of rankings)		(# of features ranked)		(average ranking)*
*carry your answer out to one decimal place				

- Step 4.** Evaluate the overall management practices and site conditions.
- 3.6-4.0 = best management
- 2.6-3.5 = good management
- 1.6-2.5 = fair management
- 1.0-1.5 = poor management
- This ranking indicates how water well management and conditions as a whole might affect groundwater quality. This ranking should serve only as a general guide, not a precise diagnosis. Since it represents an average of many individual rankings, it can mask any individual rankings (such as 1's and 2's) that should be of concern.

- Step 5.** Look over the rankings for individual features of each site:

**Best** (4's): best management according to current guidelines

**Good** (3's): provides reasonable groundwater protection

**Fair** (2's): inadequate protection in many situations

**Poor** (1's): poses a high risk of polluting groundwater

Regardless of the overall ranking, any individual rankings of "1" should receive immediate attention. Some problems can be taken care of right away; others could be major or costly projects, requiring careful planning before action is taken.

- Step 6.** Consider how farmstead management practices or site conditions could be modified to better protect groundwater. For more information, contact the local Conservation District, Penn State Cooperative Extension office, or the USDA Natural Resources Conservation Service.

---

## GLOSSARY

**Abandoned well:** A well that is unused or no longer functions, possibly a health or safety hazard. Pennsylvania law P.L. 1840, No. 610 requires landowners to properly seal or fill an abandoned well.

**Air gap:** An air space (open space) between the hose or faucet and water level, representing one way to prevent backflow of liquids into a well or water supply.

**Aquifer:** A water-bearing zone.

**Backflow:** The unwanted reverse flow of liquids in a piping system.

**Casing:** Steel or plastic pipe installed to prevent the collapse of the well and the entrance of contaminants.

**Contaminant source:** Anything that can cause pollution, such as septic systems, fuel storage areas, pesticide storage areas, mixing facilities, barnyards, fertilizer storage areas, silos, and areas with heavy fertilizer application (N).

**Cross connection:** A link or channel between pipes, wells, fixtures, or tanks, carrying contaminated water and those carrying safe drinking water. If the contaminated water is at a higher pressure, it may enter the drinking water system.

**Drilled wells:** Wells constructed by specialized hard rock drills turned either by hand or power equipment. Drilled wells are often more than 200 feet deep, and are 4 to 8 inches in diameter.

**Driven point (sand point) wells:** Wells constructed by driving assembled lengths of pipe into the ground with percussion equipment or by hand. These wells are usually 2 inches or less in diameter, are less than 50 feet deep, and can be installed in areas of relatively loose soils such as sand.

**Dug wells:** Large diameter, shallow wells usually constructed by hand.

**Groundwater:** Water beneath the earth's surface that supplies wells and springs.

**Grout:** Bentonite clay or a slurry of neat cement used to seal the space between the outside of the well casing and the bore hole (annular space) or to seal an abandoned well.

**Pasteurized Milk Ordinance:** Sets national standards to facilitate the shipment and acceptance of milk and milk products of high sanitary quality in commerce. Enforcement is the responsibility of the Pennsylvania Department of Agriculture and the U.S. Food and Drug Administration. For more information, contact the Pennsylvania Department of Agriculture.

**Protective layer:** A subsurface layer of low permeability that limits infiltration of water into a groundwater aquifer.

**Public Law 1840 Act 610:** Pennsylvania act which defines and provides for the licensing of water well drillers and is designed to prevent pollution of underground waters. Enforcement is the responsibility of the Pennsylvania Bureau of Topographic and Geologic Survey.

**Water table:** The upper level of a soil zone where all the spaces between the soil particles are filled with water or saturated.

**Well cap:** A cap or plate used to cover the top of a well-casing pipe to prevent surface water or solid material from entering the well.

---

## ACKNOWLEDGMENTS

The Pennsylvania Farm•A•Syst package contains the following worksheets:

- Introduction
- Farmstead Map
- Preliminary Screening Quiz
- Worksheet #1 - Water Well Condition and Construction
- Worksheet #2 - Pesticide and Fertilizer Storage and Handling
- Worksheet #3 - Household Wastewater Treatment System
- Worksheet #4 - Barnyard Conditions and Management
- Worksheet #5 - Milkhouse Wastewater Management
- Worksheet #6 - Stream and Drainageway Management
- Overall Farmstead Ranking

Material for the Pennsylvania Farm•A•Syst package was developed by revising Farm•A•Syst material from the University of Wisconsin Cooperative Extension Service, University of Minnesota Extension Service, and the National Farmstead Assessment System Program. The format and style for the Pennsylvania package was based on the Ontario Environmental Farm Plan published by Ontario Farm Environmental Coalition, Ontario, Canada.

Partial funding for the development of the Pennsylvania Farm•A•Syst package was provided by the Pennsylvania Association of Conservation Districts through the Chesapeake Bay Program from the U.S. Environmental Protection Agency and the Pennsylvania Department of Environmental Protection.

Preparation: **Shelly Ogline**, Project Assistant, Penn State Cooperative Extension; **Les Lanyon**, Associate Professor of Soil Fertility, Penn State, Department of Agronomy.

Project Coordinators: **Barry Frantz**, Pennsylvania Association of Conservation Districts; **Les Lanyon**, Associate Professor of Soil Fertility, Penn State, Department of Agronomy; **Jerry Martin**, Penn State Cooperative Extension.

Advisory Committee: **Larry Martick**, District Manager, Adams County Conservation District; **Lamonte Garber**, Agricultural Specialist, Chesapeake Bay Foundation; **Lori Sandman**, Project Leader, Dairy Network Partnership; **Amanda Ritchey**, Ridge and Valley Coordinator, Pennsylvania Association for Sustainable Agriculture; **Tom McCarty**, Multi-county Water Quality Agent, Penn State Cooperative Extension; **Susan Fox**, Extension Agent, Penn State Cooperative Extension, Bedford County.

Technical Review: **William Sharpe**, Professor of Forest Hydrology, Penn State; **Mike Moore**, Hydrogeologist Supervisor, Pennsylvania Bureau of Topographic and Geologic Survey; **John Miele**, Park Manager, Pennsylvania Bureau of State Parks; **Jeff Mahood**, Environmental Planning Specialist, USDA Natural Resources Conservation Service; **Bill Bowers**, State Conservation Engineer, USDA Natural Resources Conservation Service; **Peter Tarby**, Nutrient Management Specialist, Pennsylvania Department of Environmental Protection.

---

PENNSTATE



College of Agricultural Sciences • Cooperative Extension

Development of this publication was supported in part by the Extension Service, U.S. Department of Agriculture, under Special Project No. 91-EHUA-1-0061.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture and the Pennsylvania Legislature. T. R. Alter, Interim Director of Cooperative Extension, The Pennsylvania State University.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. The Pennsylvania State University does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 201 Willard Building, University Park, PA 16802-2801: Tel. (814) 865-4700/V, (814) 863-1150/TTY.

© The Pennsylvania State University 1997 2M497PS