

Household Wastewater Treatment System

WHY BE CONCERNED?

Nearly one-third of Pennsylvania residents rely on private household waste treatment systems. Maintenance of these systems is the responsibility of the home owner. Up to 50% of the solids retained in a septic system decompose while the remainder accumulate in the tank. Septic tanks need to be pumped every 3 to 5 years to prevent the solids from escaping the tank and clogging drain-fields. The frequency of the pumping depends on the size of the septic tank and the number of people it serves.

Septic system regulations enacted in 1966 set uniform standards for construction and repair of septic systems. Systems installed before this date may be prone to drainfield malfunctions. Systems that have been in place for more than 20 years and have not been inspected may be leaking disease-causing organisms and nutrients into groundwater or surface water.

Nutrients such as nitrate-nitrogen can contaminate the groundwater supply. Phosphorus from detergents can excessively enrich surface water. Excess nutrients in surface water can cause overgrowth of vegetation, which harms (smothers) aquatic life.

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 household wastewater management conditions and practices that are related to potential groundwater or surface water contamination.
- You can rank your household waste management practices according to how they might affect groundwater or surface water.
- 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 and surface water.

HOW TO COMPLETE THE WORKSHEET

Follow the directions listed on Page 2 of the worksheet. It should take 15 to 30 minutes to complete the evaluation and determine your ranking. Evaluate each household wastewater treatment system on your farmstead for its effect on groundwater and surface water. Space is provided to rank up to 3 sites on your farmstead. If you have more than 3 sites, please use another worksheet. Directions for determining your ranking are on the last page of the 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 # 3: HOUSEHOLD WASTEWATER TREATMENT

Use a pencil, in case you want to change an answer later. For each feature listed on the left that applies to your farmstead, read across to the right and circle the statement that most closely describes your situation. Leave blank any features that don't apply to your farmstead. Find the 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 through your household waste management.

HOUSEHOLD WASTEWATER TREATMENT

	4 Best	3 Good	2 Fair	1 Poor	RANK (up to 3 sites)
SYSTEM DESIGN AND CONSTRUCTION					Site Identification
					#1 #2 #3
1. Type of system	Municipal connection. ^a	Septic system with a drainfield, sand mound, or approved alternative.	Septic system without a drainfield, sand mound, or approved alternative.	Cesspool or alternative with no treatment.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
2. Age of system^b	Less than 10 years.	10-20 years.	20-30 years.	More than 30 years.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3. Design and construction^c	Approved system by the Sewage Enforcement Officer (SEO).	_____	_____	<i>System never approved by SEO.^c</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
A. Septic tanks	Septic tank adequately sized. ^d	Minimum 900 gallon septic tank.	_____	<i>Septic tank not adequately sized.^c</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
B. Absorption area or sand mound	Absorption field or sand mound adequately sized. ^d	_____	_____	<i>Absorption area or sand mound not adequately sized.^c</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4. Minimum separation distances^e					
A. Treatment tanks	Greater than distances required by Pennsylvania regulations	Minimum distance required by Pennsylvania regulations.	_____	Less than distance required by Pennsylvania regulations.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
B. Absorption fields or sand mounds	Greater than distances required by Pennsylvania regulations.	Minimum distances required by Pennsylvania regulations.	_____	Less than distance required by Pennsylvania regulations.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Site Identification #1.	_____				
#2.	_____				
#3.	_____				

^a If you are using a municipal connection, do not complete the rest of the worksheet. Put your ranking in this section in the "total" box at end of this chart.

^b Records of septic system installations (permits, etc.) are kept in the township office. The township may be able to provide information on a septic system if the system was installed in the 1970's or later.

^c Italic type indicates a violation of Pennsylvania Chapter 73 regulations.

^d Please see calculations and rule of thumb included at end of this worksheet for proper sizing of septic tanks and absorption areas. For more information, consult your township or municipal Sewage Enforcement Officer (SEO).

^e Please see attached list of minimum separation distances.

	4 Best	3 Good	2 Fair	1 Poor	RANK (up to 3 wells)
QUANTITY AND QUALITY					Site Identification
					#1 #2 #3
5. Quantity of wastewater	Conservative water use (less than 20 gal/person/day). Use of properly functioning water-conserving fixtures. No water softener. Whole house use is less than design capacity. ^a	Moderate water use (20-60 gal/person/day). Fair maintenance of water conservation fixtures. Water softener recharges twice a week or less. Whole house use is near design capacity. ^a	High water use (60-120 gal/person/day). Poor maintenance of fixtures. Water softener recharges more than twice a week. Whole house use occasionally exceeds design capacity. ^a	Excessive water use (greater than 120 gal/person/day). Leaking plumbing fixtures and/or no water-conserving fixtures. Whole house use frequently exceeds design capacity. ^a	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6. Quality of wastewater					
A. Settleable solids	No use of garbage disposal unit in sink.	Rare use of garbage disposal unit (1-2 times per week).	Occasional use of garbage disposal unit (3-5 times per week).	Daily use of garbage disposal.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
B. Dissolved solids	Minimal use of household chemicals (cups per week). No disposal of solvents and toxic cleaning agents. No water softener, or not recharged on site.	Careful use of household chemicals (pints per week). Minimal disposal of solvents or toxic cleaning agents. Water softener used, recharged on site.	Moderate use of household chemicals (quarts per week). Moderate disposal of solvents and toxic cleaning agents.	Extensive use of household chemicals (gallons per week). Extensive disposal of solvents and toxic cleaning agents.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
C. Floatable solids	No disposal of grease or oils into septic system. Domestic waste only.	Rare disposal of grease or oils into plumbing system (once per week). Oil and grease wiped from cooking utensils before washing.	Occasional disposal of grease or oils (2-3 times per week). No attempt to reduce disposal of grease and oil from household.	Frequent disposal of grease or oil (more than 3 times per week).	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7. Collection of wastewater	All wastewater collected for treatment. No clear water collected. No leakage/loss of water that should be treated. No settling of soil near tank or collection system. Collection system (pipe) more than 75 feet from well.	All wastewater collected for treatment. Some clear water collected. No leakage/loss of water that should be treated. Collection system 75-50 feet from well.	Some wastewater diverted, or some leakage of water that should be treated, and clear water infiltration. Collection system 75-50 feet from well.	Clear water infiltration. Definite leakage/loss of water that should be treated. <i>Collection system (pipe) less than 50 feet from well.^b</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

^a See section on sizing of systems at the end of the worksheet.

^b Italic type indicates a violation of the Pennsylvania Chapter 73 regulations.

	4 Best	3 Good	2 Fair	1 Poor	RANK (up to 3 wells)
TREATMENT SYSTEM					Site Identification
					#1 #2 #3
8. Septic tank ^a	-----	Multiple tanks or added solids retention system. No leakage. Pumped at least every 2-3 years and regularly maintained. Baffles and tanks checked; no leakage.	Single tank pumped every 2-5 years. Multiple tanks pumped every 4-5 years.	Leakage losses. Seldom pumped (greater than 5 year intervals). <i>Less than 50 feet from well.</i> ^b Less than 3 feet from sinkhole, groundwater table, or bedrock.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
OR					
9. Elevated sand mound	Installed by licensed installer. At least 6 feet of soil between bottom of aggregate and top of limiting zone. No equipment on plowed soil before sand is in place.	Installed by licensed installer. 4-6 feet of soil between bottom of aggregate and top of limiting zone. No equipment on absorption area during construction.	Installed by licensed installer. 4 feet of soil between bottom of aggregate and top of limiting zone. Minimal equipment traffic on absorption field during installation.	<i>Less than 4 feet of soil between bottom of aggregate and top of limiting zone.</i> ^b Some compaction in absorption field due to traffic during construction.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
OR					
10. Holding tank	Excess capacity for usual pumping interval. More than 75 feet down-slope from well. Tanks checked, no leakage. Permit acquired.	Excess capacity for usual pumping interval. 50-75 feet upslope from well. Tanks checked, no leakage. Permit acquired.	Occasional overflow or failures. 50-75 feet from well. Permit acquired.	<i>Less than 50 feet from well.</i> ^b Leakage losses. Upslope from well. <i>No permit acquired.</i> ^b	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
OR					
11. Packaged aerobic system	Maintenance program followed. Loaded at less than design capacity.	Maintenance program followed. No mechanical failures. Loaded near design capacity.	Regular maintenance program not followed. Occasional failures (once every 2 years).	No maintenance program. Frequent system failure. Load exceeds design capacity.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
OR					
12. Cesspools	-----	-----	-----	Any cesspool or direct discharge of water.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
OR					
13. Treatment in addition to septic system	Aeration, denitrification, filtration, disinfection, and/or constructed wetland.	Aeration and/or denitrification.	Filtration and/or disinfection.	No additional treatment.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
DISPOSAL OF WASTES					
14. Absorption field	-----	Exceeds minimum horizontal distance regulations (see attached list). Pressure or gravity-fed distribution to trench, bed, or mound system.	Meets minimum horizontal distance regulations. Undersized trench, bed, or leaky mound.	<i>Less than minimum horizontal distance regulations. Pipe to a drain without an absorption field.</i> ^b	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
15. Disposal of pumped septage	Approved off-site treatment and disposal of septage by a pumper-hauler.	Approved on-farm application of septage stabilized with lime. Immediate incorporation.	Approved on-farm application of septage stabilized with lime. No incorporation.	On-farm application of raw septage not approved. ^c	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

^a New regulations by the Pennsylvania Department of Environmental Protection specify that all new systems must have multiple tanks installed.

^b Italic type indicates a violation of Pennsylvania Chapter 73 regulations.

^c Violation of Pennsylvania Solid Waste Management Act, Act 97 (1980, as amended). Contact the Pennsylvania Department of Environmental Protection for more information.

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 household waste treatment practices as a whole might affect groundwater and surface-water 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 and surface water protection

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

Poor (1's): poses a high risk of polluting groundwater or surface water

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 and surface water. Contact the township or municipality Sewage Enforcement Officer, Conservation District, Penn State Cooperative Extension office, or the USDA Natural Resources Conservation Service for ideas, suggestions, or guidance.

CALCULATIONS FOR ADEQUATELY SIZED SEPTIC TANKS, ABSORPTION FIELDS, AND SAND MOUNDS

SEPTIC TANK SIZING

1. The minimum liquid capacity of a septic tank for any system should be 900 gallons.
2. For single-family dwellings not served by a community system, a minimum flow of 400 gallons per day should be used to determine adequate septic tank capacity. Increase the minimum 400 gallons per day flow rate by 100 gallons for each additional bedroom over three.
3. The minimum capacity of any septic tank for most situations can be calculated from the following table, using estimated daily sewage flows.

Design flow (gallons per day)	Tank capacity (gallons)
0-500	(3.5 x flow exceeding 400 gpd) + 900
500-5000	(1.5 x flow exceeding 500 gpd) + 1250

ABSORPTION FIELD SIZING FOR ALL SYSTEMS AND SAND MOUNDS

Calculations for appropriately sized absorption areas and sand mounds can be found in the Pennsylvania Chapter 73 regulations. The soil's percolation rate, in minutes per inch, must be considered when sizing an absorption area. For a regular septic system, not requiring a sand mound, a general rule can be used.

$$(1.19) \times (\text{total flow per day}) = \text{square feet of absorption area}$$

There are exceptions to this rule, so refer to Chapter 73 or see your local Sewage Enforcement Officer (SEO) for details. For very fast (less than 5 minutes per inch) and very slow (greater than 91 minutes per inch) percolation rates, an absorption area is unsuitable, and therefore a private septic system cannot be installed.

To estimate the size for an elevated sand mound, the following general rule can be used.

$$(1.50) \times (\text{total flow per day}) = \text{square feet of absorption area}$$

There are exceptions to this rule, so refer to Chapter 73 or your local SEO. For percolation rates of less than 3 minutes per inch and greater than 121 minutes per inch, an elevated sand mound is not appropriate.

SOURCE: Pennsylvania Code, Title 25. Environmental Resources Chapter 73. Standards for Sewage Disposal Facilities.

MINIMUM SEPARATION DISTANCES

TREATMENT TANKS

These are the distances required between any treatment tanks and the following features:

FEATURES	MIN. DISTANCE
Property line, easement, or right-of-way	10 feet
Occupied buildings, swimming pools, driveways	10 feet
An individual water supply or water supply system suction line	50 feet
Water supply line under pressure	10 feet
Streams, lakes, or other surface waters	25 feet

ABSORPTION AREAS

These are the distances required between any absorption areas and the following features:

FEATURES	MIN. DISTANCE
Property line, easement, or right-of-way	10 feet
Occupied buildings, swimming pools, driveways	10 feet
An individual water supply or water supply system suction line	100 feet
Water supply line under pressure	10 feet
Streams, lakes, or other surface waters	50 feet
Other active on-lot systems	20 feet
Surface drainageways	10 feet
Mine subsidence areas, bore holes, or sinkholes	100 feet
Rock outcrop or identified shallow pinnacle	10 feet
Natural or constructed slope greater than 25%	10 feet

SOURCE: Pennsylvania Code, Title 25. Environmental Resources Chapter 73. Standards for Sewage Disposal Facilities

GLOSSARY

Approved disposal site: A site for land application of wastewater or tank pumpage that meets state standards and is approved by the state regulatory agency.

Cesspool: Covered excavation in the ground that receives sewage directly from the building's sanitary drainage system. It is designed to retain the organic matter and solids and allow liquid to seep into soil cavities. A cesspool is an antiquated treatment system that predates current standards and does not adequately protect the public health.

Clear water infiltration: Entry of water that does not need treatment into a septic system through unsealed joints, access ports, and cracks, such as rainfall or tile drainage water or any water not generated from inside the house.

Design capacity: The maximum volume of liquid that can be treated in a particular wastewater treatment system. For systems that include subsurface wastewater disposal and distribution, capacity is also based on the soil's ability to accept and treat sewage effluent.

Effluent: Liquid discharged from a septic tank or other treatment tank.

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

Household chemicals: Items such as detergents, solvents, bleaches, cleaners, and pesticides, etc.

Off-site disposal: Disposal of wastewater or sludge at an off-farm site, such as a municipal treatment plant or approved disposal site.

Packaged aerobic system: Similar in design to a septic tank system except that the septic tank is replaced by an "aerobic" (aeration) tank. Air is stirred or bubbled into the wastes, which breaks down the material and results in a reasonably clear liquid and sludge. The liquid is discharged to the leaching bed and the sludge must be periodically pumped from the "aerobic" tank.

Pretreatment: The first step in treating wastewater to make it suitable for further treatment or disposal. For example, the septic tank retains most of the sludge from the wastewater, making further treatment in the leaching bed more effective.

Seepage pit (dry well): Underground receptacle constructed to permit disposal of septic tank effluent, treated wastes, or clear wastes by soil absorption through its bottom and walls.

Septic tank system: Consists of a separate tank to settle the solids out of the wastewater, followed by an underground leaching bed in which the wastewater is treated and dispersed in the soil.

Treatment: Eliminating the components of wastewater or reducing their concentration, so that they are not harmful to human health or the environment.

Wastewater: Waste of domestic origin, including waterborne waste from kitchen, laundry, and bathrooms (toilet, shower, and tub).

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

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