Are Your Homestead Practices Affecting Your Drinking Water Supplies?

Keeping Idaho's Water Clean

The Homestead Assessment System provides you with accurate first-hand information about how your homestead structures, such as your well or septic system, and activities such as pesticide storage or manure handling might affect your drinking water. Some homesite practices and structures pose high risks of contaminating ground water and your drinking water supplies. Others pose a low risk or virtually no risk of contamination at all. Your drinking water is least likely to be contaminated if you follow appropriate management procedures or dispose of wastes in a location that is off the homesite. Proper offsite disposal practices are, however, essential to avoid contaminating the water supplies and health of others.

Some of the information you obtain will be reassuring. Some of it may encourage you to consider modifying your structures or practices. Either way, you will have the information you need to do the best possible job of protecting the ground water you depend upon for your family's drinking water.

Participating in the Idaho Home*A*Syst project is entirely **voluntary**. The materials have been designed as a **confidential** service for Idaho residents. Users of the materials decide what to do with the results of their own assessments and keep them as their **private records**.

What is the Homestead Assessment System?

- The Homestead Assessment System (**Home*A*Syst**) is a series of fact/worksheets that will help you assess how effectively your homestead practices and structures protect your drinking water.

- The worksheets ask you about your homestead structures and activities. Your answers will help you see how your homestead practices might affect your well water.

- Corresponding material will provide information about practices and structures that can help reduce the risk of ground-water contamination. Each fact/worksheet also contains information on who to call for help and additional references on each topic.

Though field practices also have the potential to contaminate ground water, the **Home*A*Syst** series is not designed to address these concerns. **These worksheets deal with the potential effect of practices and structures on or near your homestead upon your drinking water supplies.**

Home*A*Syst Is a 3-Step Process

Step 1: Fact/worksheets help you assess the ground-water pollution potential of your homestead structures and activities, as well as providing additional information if needed. You select the appropriate fact/worksheets from the following topics:

1: Drinking Water Well Condition
2: Pesticide Storage and Handling
3: Fertilizer Storage and Handling
4: Petroleum Product Storage
5: Farm and Home Waste Management
6: Household Wastewater Treatment
7: Animal Manure Storage
8: Animal Lot Management
9: Silage Storage
10: Milking Center Wash Water Treatment
11: Lawn and Garden Management
12: Pasture and Riparian Management
13: Storm Water Management

Step 2: A separate site evaluation (**Worksheet A**) helps you assess how soil and geologic features affect the ground-water pollution potential on your homestead.

Step 3: An overall evaluation (**Worksheet B**) combines the results of steps 1 and 2, allowing you to:

- Inventory all potential sources of contamination.
- Compare potential contamination sources to see where improvements are needed most.
- Determine where to spend your time and money most effectively to protect the ground water that provides your drinking water.

You may need help getting information about site characteristics on your homestead. Worksheet A will provide suggestions on where to obtain information on the soils and geology of your homestead. Otherwise, you should be able to complete the worksheets yourself. Plan on spending about 15 to 30 minutes to complete each worksheet you select. Worksheets A and B will take additional time, as will reading the management information provided with each fact/worksheet.

To Order

Contact the Idaho Association of Soil Conservation Districts, P.O. Box 2637, 802 W. Bannock, Hoff Building, Suite 1006, Boise, Idaho 83701, (208) 338-5900,

or

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Assessing and reducing the risk of ground-water contamination from

Drinking Water Well Condition

Keeping Idaho's Water Clean

Fact/Worksheet 1

Why should I be concerned?

About 90 percent of this country's rural residents use ground water to supply their drinking water and homestead needs. Wells generally provide clean, safe water. If improperly located, constructed, or maintained, however, they can allow bacteria, pesticides, fertilizer, or oil products to contaminate ground water. These contaminants can put family and animal health at risk.

There are many documented cases of well contamination originating from homestead activities near drinking water wells. The condition of your well and its location in relation to contamination sources determine the risk it poses to the water you drink. For example, a cracked well casing may allow bacteria, nitrates, oil, and pesticides to enter the well. A spill of pesticides being mixed and loaded near the well could result in a serious contamination of your family's drinking water supply. Feedlots, septic systems, fertilizer applications, and waste storage areas can release large amounts of contaminants which may affect your well.

Preventing well water contamination is very important, and once the ground water supplying your well is contaminated, it is very difficult to clean up. The only options may be to treat the water, drill a new well, or obtain water from another source. A contaminated well can also affect surrounding wells, posing a serious health threat to others.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your drinking water well condition and management practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your drinking water well condition and management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 12. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Focus on the well that provides drinking water for your homestead. If you have more than one drinking water well on your homestead, fill out a worksheet for each one.

Glossary

Drinking Water Well Condition

These terms may help you make more accurate assessments when completing Fact/Worksheet 1. They may also help clarify some of the terms used.

Abandoned water well: A well which has been filled or plugged so that it is rendered unproductive and will prevent contamination of the ground water. A properly abandoned well will not produce water nor serve as a channel for movement through the well or between water bearing zones. Wells that are not used should be properly abandoned as soon as possible.

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

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent unwanted reverse flow of liquids back down a water supply pipe into a well.

Aquifer: An underground formation of rock or sediments containing and capable of supplying ground water.

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

Backsiphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Casing: Steel pipe installed while drilling a well, to prevent collapse of the well borehole, entrance of contaminants, and to allow placement of pumping equipment.

Cross-connection: A link or channel between pipes, wells, fixtures, or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water can enter the potable water system if it is under higher pressure.

Drilled wells: Any drilled excavation that is constructed with the intended use of for the location, diversion, artificial recharge, observation, monitoring, de-watering, or withdrawal of ground water.

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

Dug wells: Large-diameter, relatively shallow wells lined with rock, brick, or concrete and often hand constructed. Typical dug wells are three to six feet in diameter and 15 to 50 feet deep.

Ground water: Subsurface water in soil, rock or sediment.

Grout: A fluid mixture of cement, bentonite, and water which is used to seal the space between the borehole and casing, or to properly fill and seal abandoned wells.

Milligrams per liter (mg/L): The weight of a substance measured in milligrams contained in one liter. It is equivalent to 1 part per million.

Glossary

Drinking Water Well Condition

--continued--

Parts per million (ppm): A measurement of concentration of one unit of material dispersed in one million units of another.

Pitless adapter: An assembly placed below the frost line which permits pumped well water to pass through the casing without allowing contaminants to enter.

Unused well: A well that is unused, unmaintained, and/or is in disrepair. An unused well should be properly abandoned as soon as possible.

Water table: The upper level of ground water in the unconfined zone saturated with water. It fluctuates with climatic conditions on land surface, and with aquifer discharge and recharge rates.

Well cap: A manufactured device installed at the top of a well casing which creates an air and watertight sanitary seal to prevent surface water and contaminants from gaining access to the ground water supply.

Improving Drinking Water Well Condition

Keeping Idaho's Water Clean

This materials set addresses well conditions for non-public 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 Health and Welfare-Division of Environmental Quality (IDHW-DEQ). All other drinking water systems are considered to be non-public, and the day-to-day operation of these wells is not regulated. These wells, however, have minimum construction standards that are regulated by the Idaho Department of Water Resources (IDWR).

The design, construction, and operation of a well can significantly impact water quality. Thus, it is important to consider actions now to prevent the contamination of your drinking water supplies 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 pollution sources. The general rule for protecting the water supply is to **keep a well up-slope 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 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, its 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. IDWR Well Construction Standards Rules (25.01.a.) requires that constructed wells must meet all siting and distance requirements set forth by the appropriate public health districts and Idaho Department of Health and Welfare 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.**

There is no specific distance that will guarantee that the well will not be affected. Make every effort, however, to always provide as much separation as possible between your well and any potential contamination source(s).

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 on adjacent properties as well.

Changing the location of contamination sources 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 if your well is far away from the potential source. 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.

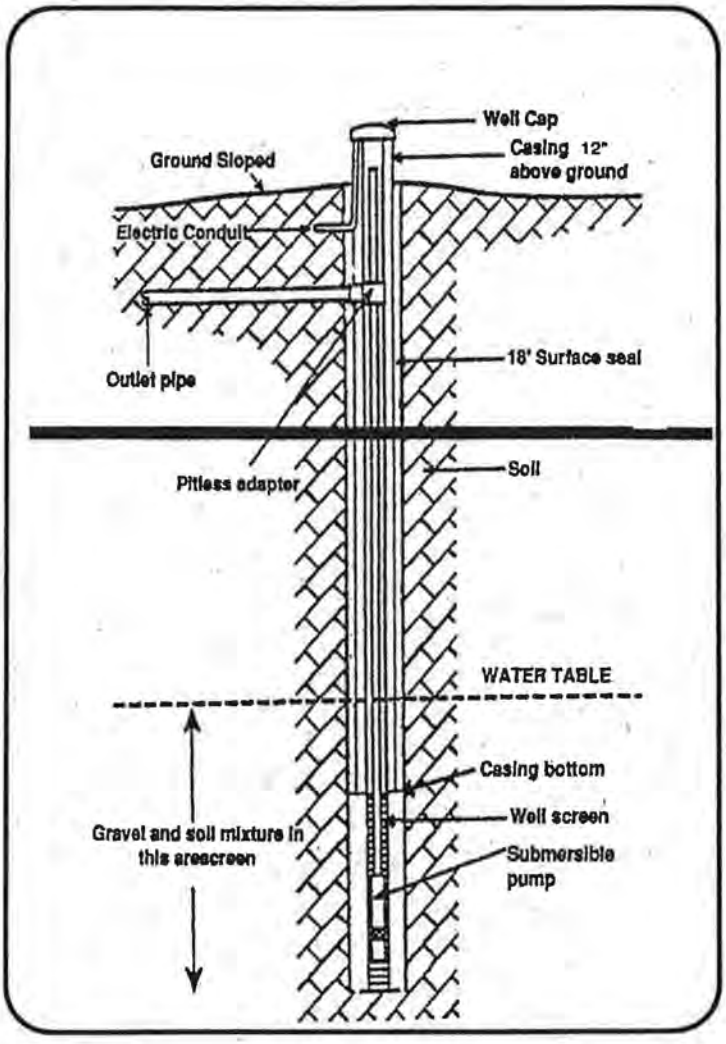

Figure 1: Required construction components for new wells.

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 located in pits, or constructed without grout or a sanitary well seal, can allow surface water to carry bacteria, pesticides, fertilizer, or petroleum products into your drinking water supply.

Several items concerning well construction that should be checked are described in the following sections. Well construction information may 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. The location of your well, reported by township, range, section (1/4 of a 1/4 section or 40 acres), and the name of the person who the well was drilled for will be needed to locate your well log.

Well construction reports, for wells drilled prior to 1987, were not required to be filed with IDWR and therefore may not be readily available. 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, the driller installs a tight-fitting, vermin-proof well cap to prevent easy removal by children or entry of insects or surface water. Well regulations require a vermin-proof seal for all private wells (not all wells have caps; some may have pumping equipment attached at the surface). 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's in place and tightly secured. Electrical wires entering the well should be in an approved conduit.

Casing depth and height

As stated in Idaho Well Construction Standards Rules 25.02.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 along with casing the well deeper can provide greater protection, so you may want to consider exceeding the minimum casing depth.

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. Idaho well regulations require that at least 12 inches of casing pipe extend above the final grade of the land. 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.

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 known to exist. Dug wells will usually be 15 to 50 feet deep.

Driven-point (sand point) wells are constructed by driving assembled lengths of pipe into the ground. These wells are normally smaller in diameter (two 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 wells which draw from the ground water nearest the land surface are generally more quickly affected by surface activities such as pesticide usage. Local geologic conditions determine how long it takes for 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 water table.

3. Managing and maintaining existing wells

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.

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 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**), as well as other publications (consult the *Contacts and References* section).

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 backsiphoning 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 backsiphoning 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 or your local public health district. A good initial set of tests for a private well includes hardness, alkalinity, pH, conductivity, and chloride. If the well draws from sandy materials or granite bedrock, a test

for corrosives may be desirable.

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, and herbicides/ 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 volatile organic chemicals (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:

- Your well has nitrate levels greater than 10 mg/L (reported as nitrate-nitrogen, NO_3-N) or 44 mg/L (reported as nitrate, NO_3).
- A pesticide spill or back-siphoning has occurred near the well.
- 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 or county Cooperative Extension System office.

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 your county Cooperative Extension System office or 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 Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-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.

Keep in mind that activities off of your property can also affect your ground water. 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.

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. There is no specific distance from a potential contamination source that will guarantee the well will not be affected.
- 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 in your area for additional information.

Worksheet 1

Drinking Water Well Condition: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead.
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15-30 minutes to complete the worksheet and summarize your risk rankings for well management practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
WELL LOCATION *(Addressed in Section 1)*					
Position of drinking water well in relation to contamination sources	Up slope from all potential sources of contamination. No surface water runoff reaches well. Surface water diverted from well.	Up slope from or at grade with potential sources of contamination. No surface water runoff reaches well.	Down slope from most potential sources of contamination. Some surface water runoff may reach the well.	Settling or depression near casing. Surface water runoff reaches the well.	____
Separation distances between well and homestead contamination sources*	All potential sources of contamination are greater than the recommended separation distances from the well.	Most potential sources of contamination meet the recommended minimum separation distances from the well.	Some potential sources of contamination meet the recommended minimum separation distances from the well.	None of the potential sources of contamination meet the recommended minimum separation distances from the well.	____
Soil (≤ 5' below ground surface) potential to protect ground water	Fine-textured soils (clay loams, silty clay).	Medium-textured soils (silt loam, loam).	Medium textured soils.	Coarse-textured soils (sands, sandy loam).	____
Geology (≥ 5' below ground surface) potential to protect ground water	____	Clay layers present above the water bearing zones.	Clay layers absent above the water bearing zones.	Fractured consolidated formations such as basalts	____

*See page Fact/Worksheet 1, page 4, *Drinking Water Well Condition*, Separation Distances.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
WELL CONSTRUCTION* *(Addressed in Section 2)*					
Condition of casing, well cap, and pitless adapter	No holes or cracks in casing. An approved sanitary well cap tightly secured. Screened vent. Pitless adapter in place.	No defects visible. Approved sanitary seal tightly secured. Well vented but not screened.	No holes or cracks visible. Cap loose.	**Cap missing or loose.** No pitless adapter. **Holes or cracks visible. Can hear water draining.**	____
Casing depth and surface seal	Casing extends below water level in well and is more than 18 feet below surface. At least 18 feet of surface seal is in place, or into the confining layer above the aquifer in which the well is completed.**	Casing extends to water level, but not less than 18 feet below surface. Required 18-foot surface seal is in place.**	**Surface seal missing or less than required depth.****	**No surface seal.****	____
Casing height above land surface	More than 12 inches above grade. No flood water reaches well.	12 inches above grade. Possibility of flood water reaching well.	**Less than 12 inches above grade.** Possibility of flood water reaching well.	**Below grade or in pit or basement. Likely to be flooded.**	____
Well age	Constructed following Idaho well guidelines, enacted 1987.	———	Constructed and seal is placed before 1987.	Not constructed according to Idaho regulations.	____

Boldface type: Besides representing a higher-risk choice, this practice also violates Idaho law.

*See page 5 of *Fact/Worksheet 1* for well construction requirements in Idaho.
**An 18 foot surface seal is required for all new well installations. Existing wells must meet requirements in effect at time of construction. Placement of a surface seal in all wells is required.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
WELL MANAGEMENT *(Addressed in Sections 3, 4, and 5)*					
Backflow prevention	Anti-backflow devices (such as check valves) installed on all faucets with hose connections. No cross-connections between water supplies.	Anti-backflow devices installed on some faucets with hose connections.	No anti-backflow devices. Air gap maintained.	No anti-backflow devices. Air gap not maintained. Cross-connections between water supplies.	____
Water testing	Regular annual testing. Records indicate consistent, satisfactory water quality. Bacteria, nitrate, and other tests meet standards.	Regular testing. Records indicate increased levels of bacteria, nitrate, or other contaminants, but still meet standards.	Regular testing. Bacteria, nitrate, and other tests do not meet standards some of the time but are closely monitored.	No water tests done or tests indicate bacteria, nitrate, or other contaminant levels frequently above standards. Noticeable changes in color, clarity, odor, or taste after rainstorms or during spring melt.	____
Unused wells	No unused, unsealed wells.	Unused wells properly abandoned and protected according to Idaho specifications.	Unused wells, more than 100 feet from drinking water well, not properly abandoned.	Unused well, less than 100 feet from drinking water well, not properly abandoned.	____

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Drinking Water Well Condition Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Position of well in relation to contamination sources				
Separation distances between well and contamination sources				
Soil potential to protect ground water				
Geology potential to protect ground water				
Condition of casing, well cap, and pitless adapter				
Casing depth and surface seal				
Casing height above land surface				
Well age				
Backflow prevention				
Water testing				
Unused wells				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References
Who to call 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 Idaho Drinking Water Program Division of Environmental Quality, (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 Division 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

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 Idaho Departmrnt of Water Resources office for your area: (208) 327-7900. 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 can be borrowed from your Idaho Division of Environmental Quality, Regional Office).
- *Protecting Ground Water Quality in Idaho* (brochure), Idaho Division 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.

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Pesticide Storage and Handling

Keeping Idaho's Water Clean

Fact/Worksheet 2

Why should I be concerned?

Pesticides play an important role in agriculture. They protect crop yields and enable farmers to manage more acres with less labor. However, if pesticides are not handled carefully around the rural homestead they can seep through the ground after a leak or spill, or they can enter a well directly during mixing and loading. The responsible use of pesticides by farmers will help assure the availability of safe ground water for everyone.

Pesticides work by interfering with the life processes of plants, disease organisms, insects, and rodents. Many pesticides are also potentially toxic to people. Pesticides include herbicides, fungicides, insectcides, and rodenticides. If pesticides enter a water supply in large quantities, as can happen with spills or backsiphonage accidents, **acute health effects** (toxic effects apparent after only a single exposure) are possible. Effects will vary, depending on the toxicity of the pesticide and the amount of exposure. Using ground water with low levels of contaminants for drinking water supplies may result in **chronic exposure** (prolonged or repeated exposure to low doses of toxic substances), which may be hazardous to people and animals.

When pesticides are found in water supplies, they are rarely present in high-enough concentrations to cause acute health effects, which can include chemical burns, nausea, and convulsions. Instead, they typically occur at trace levels, and the concern is primarily their potential to cause chronic health problems from prolonged exposure.

Following appropriate management procedures will greatly reduce the possibility of your drinking water being contaminated. Handle and dispose of pesticides properly to avoid risking contamination that could affect the water supplies and health of others.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your pesticide storage, handling, and disposal practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your pesticide storage, handling, and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practice might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Glossary

Pesticide Storage and Handling

These terms may help you make more accurate assessments when completing Fact/Worksheet 2. They may also help clarify some of the terms used.

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

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent the unwanted reverse flow of liquids back down a water supply pipe into a well.

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

Backflow prevention device: (See **anti-backflow device.**)

Back-siphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Closed handling system: A system for transferring pesticides or fertilizers directly from container to application equipment that minimizes the chance of exposure to the handler or environment.

Cross-connection: A link or channel between pipes, wells, fixtures, or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water, if at higher pressure, enters the potable water system.

Micrograms per liter (ug/L): The weight of a substance measured in micrograms contained in one liter. It is equivalent to 1 part per billion in liquid measure.

Milligrams per liter (mg/L): The weight of a substance measured in milligrams contained in one liter. It is equivalent to 1 part per million in liquid measure.

Parts per billion (ppb): A measurement of concentration of one unit of material dispersed in one billion total units.

Parts per million (ppm): A measurement of concentration of one unit of material dispersed in one million total units.

Pesticide: A substance used as a management tool to control a plant disease, insect, or weed. Pesticides include herbicides, fungicides, insecticides, and rodenticides.

Rinsate: Rinse water from cleaning pesticide or fertilizer container.

Secondary containment: Impermeable floor and walls around a chemical storage area that allow pesticide recovery and minimize the amount of chemical seeping into the ground in case of a spill or leak.

Wash water: Solution containing very low concentrations of chemicals resulting from cleaning application equipment.

Improving Pesticide Storage and Handling

Keeping Idaho's Water Clean

There are six important components of pesticide management on your homestead: 1) pesticide storage practices; 2) mixing and loading practices; 3) spill cleanup; 4) container disposal practices; 5) proper use according to label directions; and 6) other management practices.

When handling pesticides, wear proper protective clothing at all times. Personal protection is not addressed in **Home*A*Syst**, as its focus is ground water and drinking water protection. For more information on personal protection when handling pesticides, refer to label directions, contact your county Cooperative Extension System (CES) office or the Idaho Department of Agriculture (IDA) (see *Contacts and References* section).

1. Pesticide storage practices

If stored safely in a secure location, pesticides pose little danger to ground water. Common sense suggests keeping them dry and out of the way of activities that might knock over a jug or rip open a bag. Short-term storage (during seasonal use) poses a lower risk than year-round storage, but **any** storage regardless of length of time stored may pose a risk to ground water.

The risk of contamination increases the closer the pesticide storage area is to your well. Pesticide storage areas should be downslope and as distant from your well as possible to provide reasonable assurance well water will not be contaminated. Separation should be greater if the site has sandy soils or fractured bedrock near the land surface.

The risk of pesticide contamination of ground water is influenced by properties of both the pesticide and the soil on which it is spilled or applied. Several publications in the Contacts and References section provide more information on these topics. Also, *Worksheet A, Site Evaluation*, can help you rank your homestead soils and geologic conditions according to their ability to keep pesticides and other contaminants out of ground water.

Managing your existing storage facility

Proper management of your existing pesticide storage facility will often allow you to protect your water supply without major expense. Even when needed changes require expensive modifications to your facilities, keep in mind that compared to the cost of a contaminated well or a lawsuit, storage improvements can be a bargain.

The cheapest alternative you may have is to cut back on the amounts and types of pesticides stored, if practical. Also consider how you can protect the pesticides you keep in storage.

- Pesticide storage areas should be locked or pesticides stored in a locked cabinet out of reach of children and other unauthorized people. A locked storage cabinet or building provides security, prevents unauthorized use of pesticides, and reduces the chance of accidental spills or theft. It is recommended to provide signs or labels identifying the cabinet or building as a pesticide storage area. Areas in which pesticides are stored are required by state law to be posted as a pesticide storage area. For further information, call the Idaho Department of Agriculture (IDA), (208) 332-8500.

- Pesticides should always be stored in sound, properly labeled, original containers. Sound containers are your first defense against a spill or leak. If a container is accidentally ripped open or knocked off a shelf, the spill should be confined to the immediate area and **cleaned up immediately**.

- Steel shelves are easier to clean than wood if a spill occurs. Shelves for smaller containers should have a lip to keep the containers from sliding off.

- Store dry products above liquids to prevent wetting from spills. **Never store dry bagged materials under liquids.** Provide pallets to keep large drums or bags off the floor.

- Keep pesticides separate to prevent cross-contamination. Herbicides, insecticides, and fungicides should be kept on separate shelves or areas.

- If you plan to store large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container, plus the displaced volume of any other storage tanks in the area.

- Proper ventilation must be provided for enclosed storage areas. Check with IDA to see if your storage area falls under requirements for mandatory secondary containment.

Remodeling existing facilities that serve other uses may be less expensive than building a new facility, but remodeling can be complicated. When existing buildings must accommodate other activities, using them to store pesticides could compromise the safety of people and the environment. Storing pesticides in a separate facility reduces the risk associated with fire or accidental spills. **Never store pesticides inside a wellhouse or a facility containing an abandoned well.**

Fires in a pesticide storage area present a special hazard to people and the environment. You can reduce damages by anticipating emergencies. Entrances should be posted to alert fire fighters to the presence of pesticides and other products stored in the structure. It's a good idea to keep a list of the pesticides and amounts stored. Keep a copy of the list in the house or away from the storage area and keep it up-to-date.

If a fire should occur, consider where the surface runoff water will go and where it might collect. For example, a curb around a floor can help confine contaminated water. When making the storage area secure, also make it accessible, so you can get pesticides out in a hurry if feasible.

Building a new storage facility

Building a new facility just for pesticide storage may be expensive, but generally is safer than trying to modify areas meant for other purposes. If you build a new facility, apply the principles of safe pesticide storage mentioned above. Remember that this is your opportunity to provide the maximum amount of safety possible for your family and your drinking water supply.
Safe storage can minimize the risk of spills around your pesticide storage area. If a spill does occur, an impermeable (waterproof) floor, such as coated or sealed concrete, should virtually eliminate any seepage of pesticides into the ground. Putting a curb around the floor will prevent chemicals from spreading to other areas.

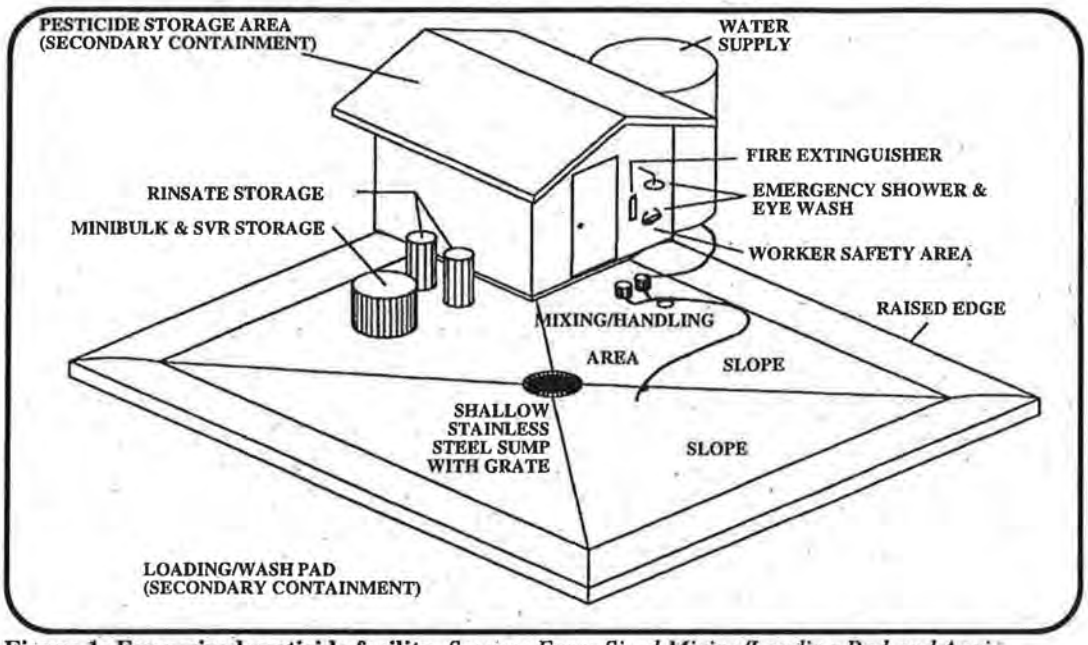

Figure 1: Farm-sized pesticide facility. *Source: Farm-Sized Mixing/Loading Pad and Agri-chemical Storage Facility, by D.W. Kammel and D. O'Neil, presented at Summer Meeting of the American Society of Agricultural Engineers, June 24-27, 1990.*

Secondary containment provides an impermeable floor and walls around the storage area, which will allow for the recovery of pesticide products if a bulk liquid pesticide storage tank should leak. Contact IDA for specifics on secondary containment rules which are being developed (208) 334-3550.

A mixing/loading pad provides for secondary containment and recovery of pesticide products during the transfer of pesticides to spraying equipment. Although sumps are recommended, there should not be any underground plumbing or storage tanks.

For information on other factors to consider when designing a storage facility, such as ventilation, temperature control, and worker safety, contact your county Cooperative Extension System office, or the Idaho Department of Agriculture.

2. Mixing and loading practices

Ground-water contamination can result even from small spills in the mixing and loading area. Small quantities spilled regularly in the same place can go unnoticed, but the chemicals can build up in the soil and eventually reach ground water. Mixing and loading on an impermeable surface, such as coated or sealed concrete, will allow containment of spilled pesticides for recovery and use as intended. Spills should be cleaned up immediately.

A mixing and loading pad

Containing pesticide spills and leaks requires an impermeable (waterproof) surface for mixing and loading. The pad should be large enough to contain leaks from bulk tanks, wash water from cleaning equipment, or to collect inadvertent spills and prevent the transfer of chemicals to the sprayer or spreader (*Figure 1*).

The size of the pad depends also on the equipment you use. It should provide space around the parked equipment for washing and rinsing. Having several rinsate (rinse water) storage tanks allows you to keep rinsate from different chemicals separate. That way, the rinsate can be used as mixing water on subsequent compatible loads.

Locate the pad next to the storage area. At sites where runoff water could reach the well, construct a diversion so runoff is directed to another area.

If you are considering constructing a mixing and loading pad, contact your county Cooperative Extension System office, the Cooperative Extension System agricultural engineer at (208) 885-7627 or the Idaho Department of Agriculture for more detailed information.

Better management of your existing mixing and loading site

Even if you don't have an impermeable mixing and loading pad, you can minimize contamination by following some basic guidelines:

- Avoid mixing and loading pesticides near your well. One way to do this is to mix and load pesticides at the field to be sprayed using a nurse tank to transport water. Mixing should not be done routinely in the same place.
- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to travel or move quickly through the soil. A clay surface is better than sand or gravel.
- Install a backsiphon or back flow prevention device on the well or hydrants to prevent reverse flow of liquids into the water supply. Never submerge the hose end inside the sprayer tank. Provide an air gap of six inches between the hose and the top of the sprayer tank, free fall the water into tank or use oversize slotted pipe extended out of the tank.
- Always supervise or observe sprayer filling. For restricted-use pesticides, a trained and certified applicator must supervise operations.
- Consider a closed handling system which transfers the pesticide directly from the original container to applicator equipment (through a hose, for example). Humans and the environment are never inadvertently exposed to the pesticide with this system.
- Use rinsate for mixing subsequent compatible loads. Spray the rinsate according to label directions. Ideally, rinsate should be used on the application location from which the rinsate was created.

3. Spill cleanup procedures

For dry spills, promptly sweep up and use the pesticide as it was intended. Dry spills are usually very easy to clean up. For liquid spills, recover as much of the spill as possible. Recovery in the original liquid form is recommended. Otherwise use soil, sawdust, or other absorbent material, and place it in a sealable container. It may have to be disposed of as hazardous waste. Contact a hazardous material contractor, IDA, or DEQ for disposal procedures.

Spills are generally considered a threat to human health or the environment. Spills or discharges to water should be reported immediately. Immediate clean up is urgent to prevent migration to ground water, wells, and waterways. Spills to porous soils should be reported immediately.

Spills within or discharges to containment structures should be cleaned up in a timely manner. For example, shop floors, concrete pads, or drip pans could be considered barriers to the environment if they prevent contact with the environment. Containment structures are not to be used to store or accumulate dangerous or hazardous wastes.

For further information or assistance or to report spills, contact the Idaho Department of Agriculture at (208) 332-8610, Idaho Emergency Response Commission, Idaho Communication Centers (Poison Control) (800) 632-8000, or the EPA Hotline (208) 424-4372.

4. Container disposal practices

Unrinsed and improperly stored containers can lead to ground-water contamination by allowing chemical residues to leak onto the ground. Some basic guidelines can help avoid similar problems:

- As often as possible, use returnable containers and minibulks and take them back to the dealer.
- Pressure-rinse or triple-rinse plastic and metal containers **immediately** after emptying, since residue can be difficult to remove after it dries. Pour rinse water into the spray tank. Puncture or cut rinsed containers and store them in a dry storage area until you can take them to a container recycling event or to a permitted landfill.
- Shake out bags, bind or wrap them to minimize dust, and take them to a permitted landfill.
- Due to current and future health risks, do not bury or burn pesticide containers or bags on the farm.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures and properly recycle or dispose of pesticide containers.

For more information about proper recycling or disposal of pesticide containers, contact the Idaho Department of Agriculture (208) 332-8500 or refer to *Fact/Worksheet 5, Improving Farm and Home Waste Management.*

5. Other management practices

Pesticide management and reducing pesticide waste makes financial as well as environmental sense, but it means more than just reducing spills. It also means not buying more than you need to apply for the current year, keeping records of what you used and have on hand, and using older products first.

- Buying only what you need makes long-term storage unnecessary. In addition, you avoid cold weather problems, which can make some pesticides useless.
- Federal USDA record keeping requirements are applicable to farmers utilizing restricted use pesticides (RUPS). Keeping accurate records of commercial pesticide applications is required by state law. Contact IDA at (208) 332-8500. Record keeping may seem like a task unrelated to ground-water contamination, but knowing what you've used in the past and what you have on hand allows you to make better purchasing decisions.
- Keep records of past field application rates and their effectiveness. Keep field records and add information such as the manufacturer's name and address, types, and handling precautions. This information can be important if you must respond quickly to an accident or wish to review historical pesticide use on a field for crop rotation or crop yield information.

Worksheet 2

Pesticide Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk ranking for pesticide storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE *(Addressed in Section 1)*					
Amount stored	No pesticides stored at any time.	Less than 1 gallon or less than 10 pounds of each pesticide.	Less than 30 gallons or less than 300 pounds of each pesticide.	More than 30 gallons or more than 300 pounds of each pesticide.	____
Types stored:					
Leachability	No chemicals stored.	Chemicals classified as having low leaching potential.	Chemicals classified as having medium leaching potential.	Chemicals classified as having high leaching potential.	____
Liquid or dry formulation	No liquids. All dry.	Some liquids. Mostly dry.	Mostly liquids. Some dry.	All liquids.	____
Location of pesticide storage area in relation to well	400 feet or more downslope from well.	150–400 feet downslope from well.	100–150 feet downslope from well.	Within 100 feet or upslope from well. Storage in well or pump house or a well lot.	____
Spill or leak control in storage area	Impermeable surface (such as coated or sealed concrete) does not allow spills to soak into soil. Curb installed on floor to contain leaks and spills.	Uncoated concrete surface with curb has some cracks, allowing spills to get to soil, **or** uncoated concrete surface without cracks has no curb.	Permeable surface (wooden floor) has some cracks. Impermeable surface has no curb. Spills could contaminate wood or soil.	Permeable surface (gravel or dirt floor). Impermeable surface with drain to a dry well. Spills could contaminate floor.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE *(continued)*					
Containers	Original containers clearly labeled. No holes, tears, or weak seams.	Containers fairly new. Labels partially missing or hard to read.	Original containers old. Labels partially missing or hard to read.	Containers are patched **or** have holes or tears that allow pesticides to leak. Metal containers show signs of rusting. **No labels.**	_____
Security	Fenced and locked area separate from all other activities.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill chemicals.	**Open access to theft, vandalism, children, or unauthorized persons.**	_____
MIXING AND LOADING PRACTICES *(Addressed in Section 2)*					
Location of mixing/ loading area in relation to well	400 feet or more downslope from well. Mixing and loading done in field.	150–400 feet downslope from well.	100–150 feet down-slope from well.	Within 100 feet or upslope from well.	_____
Mixing and loading pad (spill containment)	Covered concrete pad with curb. Transfer sump for collection cleaned after each use.	Uncovered concrete pad with curb. Transfer sump cleaned periodically.	Concrete pad with some cracks. No curb or transfer sump.	No pad. Spills soak into ground.	_____
Backflow prevention on water supply	Anti-backflow device installed or six-inch air gap maintained above sprayer tank. Hose never in tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. **Hose in tank below water line.**	_____
Water source	Separate water tank.	_____	_____	Obtained directly from water well, stream, or pond.	_____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice also violates Idaho law or pesticide label.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
MIXING AND LOADING PRACTICES *(continued)*					
Filling supervision	Constant by certified individual.	Constant by uncertified individual.	Frequent.	Seldom or never. Occasionally overflows.	____
Handling system	Closed system for all liquid and dry product transfers.	Closed system for most liquids. Some liquid and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port hard to reach.	____
Sprayer cleaning	Sprayer washed out in field.	Sprayer washed out on curbed pad at homestead.	Sprayer washed out on non-curbed pad at homestead.	Sprayer washed out at homestead. No pad.	____
Wash water (rinse water) disposal	Wash water used in next load and applied to labeled crop.	Wash water stored for later use and applied to labeled crop.	Wash water sprayed on open areas around homestead.	Wash water dumped at homestead or in field.	____
CONTAINER RINSING AND DISPOSAL *(Addressed in Section 4)*					
Container rinsing	Container pressure- or multiple-rinsed at time of application. Rinsate used in current application.	Container pressure- or multiple-rinsed at time of application. Rinsate stored for use at a later time.	Containers rinsed at a later time. **Rinsate sprayed out in same location every time.**	**Containers unrinsed and not stored in pesticide storage shed.**	____
Disposal location	Container pressure- or multiple-rinsed at time of application. Container disposed of through recycling program **or** returned to dealer.	Container pressure- or multiple-rinsed at time of application. Rinsed container disposed of at approved landfill.	Containers rinsed at a later time. Rinsed container disposed of on property.	**Unrinsed or partially filled containers, or empty bags disposed on property or at approved landfill.**	____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice also violates Idaho law or pesticide label.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Improving Pesticide Storage and Handling Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Amount stored				
Leachability				
Liquid or dry formulation				
Location of storage area in relation to well				
Spill or leak control in storage area				
Containers				
Security				
Location of mixing/loading area in relation to well				
Mixing and loading pad				
Backflow prevention on water supply				
Water source				
Filling supervision				
Handling system				
Sprayer cleaning				
Wash water (rinse water) disposal				
Container rinsate				
Disposal location				

Step 2: Look over your rankings for individual activities.

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

General pesticide information

• National Pesticide Telecommunication Network, (800) 858-PEST(7378). Provides 24-hour information (365 days a year) on pesticide poisoning, pesticide products, pesticide cleanup and disposal, enforcement contacts, pesticide certification and training programs, and pesticide laws.

• Idaho Poison Control Center, (800) 632-8000. The center provides information on who to contact in case of exposure to or spill of pesticides or any toxic substance.

Health effects of pesticides in drinking water

• Idaho Department of Heath and Welfare, Idaho Department of Agriculture (208) 332-8500, or your local public health district for all health related issues. The reporting numbers for the DEQ regional offices are:

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

Drinking water quality and treatment and health advisories

• EPA Safe Drinking Water Hotline, Monday through Friday, 5:30 a.m. to 3 p.m. Pacific Standard Time, call (800) 426-4791. DEQ can be reached at the numbers above.

Further information on chemicals

• Chemical Referral Center, sponsored by the Chemical Manufacturers Association. Call (800) 262-8200. The Center will refer a caller to the manufacturer of the chemical in question. It will also provide telephone numbers of other hotlines that address chemicals.

Pesticide storage, handling, disposal, and safety

• Your county Cooperative Extension System office, University of Idaho Ag. Engineer, or the IDA Division of Agriculture Technology (208) 332-8500, has extensive information on many facets of chemical pesticides, including environmental fate and human health effects.

What to read about...

Publications are available from sources listed at the end of the reference section (Refer to number in parentheses after each publication).

Health effects

• The product label. Read your product labels carefully for specific information on pesticide health effects.

• *Toxic Substances Fact Sheet: Pesticides,* 1988. Washington Department of Health. (6) Discusses sources, types, uses, and health effects of pesticides.

• *Health Advisory Summaries.* 1989. U.S. Environmental Protection Agency, Washington, D.C. (2) Prepared for nearly 60 substances with potential to reach drinking water, each two-page Health Advisory Summary describes a pesticide, its brand names, its potential health effects, sugested action steps, and where to go for more information.

• *First Aid for Pesticide Poisoning*, PNW0278 (1)

Pesticide storage, handling, disposal, and safety

• *Your Home, Your Health, and Pesticides,* 1990. (1)
• *A Consumer's Guide To Safer Pesticide Use.* 1987. (3) Free 25-page special reprint from the EPA Journal.
• *Chemicals in Your Community: A Guide to Emergency Planning and Right To Know Act.* 1988. (3) Contains information on implications of this law for farmers.
• *Disposing of Crop Protection Chemical Containers.* 1990. (6) ACRE Fact Sheets, numbers 5 and 12. Fact Sheet 5 provides an eight-point check list of procedures to follow for safe disposal of chemical containers. Fact Sheet 12 discusses pressure-rinsed and triple-rinsed containers and rinsed container disposal.
• *Constructing an Inexpensive Chemical Rinse Pad.* 1990. (6) ACRE Fact Sheet 14. Discusses capturing wastewater, storage of chemicals, site selection, and the design of a simple rinse pad.

Integrated pest management and other alternative pest control strategies

• *Puget Sound Pest Management Guidelines Manual,* 1993. (1) A comprehensive manual that addresses chemical and integrated pest management (IPM) strategies, and costs and benefits of both.
• *Concepts of Integrated Pest Management in Washington,* EB0753 (1) The Washington Toxics Coalition provides an extensive information service on alternative pest control methods (4).

Publications available from...

• Your county Cooperative Extension System office.
• For more information on how to obtain full health advisories or health advisory summaries, call the EPA's toll free Safe Drinking Water Hotline, (800) 426-4791, 5:30 a.m. to 3:00 p.m. Pacific Standard Time.

NOTES

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Fertilizer Storage and Handling

Fact/Worksheet 3

Keeping Idaho's Water Clean

Why should I be concerned?

Fertilizers play a vital role in increasing farm production. Commercial fertilizer is a major source of nitrogen in several chemical forms, including nitrate.

In recent years nitrate-nitrogen concentrations which exceed the public health standard of 10 mg/L* have been found in some drinking water wells. Infants less than six months of age have not developed certain enzyme systems and are particularly susceptible to health problems from high nitrate-nitrogen levels. One such condition is methemoglobinemia (blue baby syndrome). Adults may also be affected by high nitrate concentrations, but the evidence is much less certain.

Young animals may also be susceptible to health problems related to nitrate-nitrogen concentrations in the 20 to 40 mg/L range. These problems may be compounded with feeding of high nitrate-nitrogen feed sources.

Proper handling and storage of fertilizers will help prevent potential leaching of nitrate to ground water if accidental spills occur. Your drinking water is least likely to be contaminated when all appropriate management and disposal procedures are followed. Surface water may also be susceptible to contamination from nitrates if proper containment and disposal procedures are not followed.

Although fertilizers are a major source of nitrates in rural areas, other sources include septic systems, animal lots, manure storage areas, and silage storage facilities. These facilities are addressed in separate **Home*A*Syst** fact/worksheets.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

*means milligrams per liter, equivalent to parts per million for water measure

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your fertilizer storage, handling, and disposal practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your fertilizer storage, handling, and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8.
It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Glossary

Fertilizer Storage and Handling

These terms may help you make more accurate assessments when completing Fact/Worksheet 3. They may also help clarify some of the terms used.

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

Agronomic rate: The application rate that supplies the necessary plant nutrients without over applying. A soil test is needed to determine this rate.

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent the unwanted reverse flow of liquids back down a water supply pipe into a well.

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

Backflow prevention device: (See **anti-backflow device.**)

Back-siphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Closed handling system: A system for transferring pesticides or fertilizers directly from container to application equipment that minimizes the chance of exposure to the handler or environment.

Commercial fertilizer: Any substance that contains one or more recognized plant nutrients, has been biologically or chemically altered, and is used to promote plant growth. Composted manure is considered commercial fertilizer; raw manure is not.

Cross-connection: A link or channel between pipes, wells, fixtures, or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water, if at higher pressure, enters the potable water system.

Micrograms per liter (ug/L): The weight of a substance measured in micrograms contained in one liter. It is equivalent to 1 part per billion in liquid measure.

Milligrams per liter (mg/L): The weight of a substance measured in milligrams contained in one liter. It is equivalent to 1 part per million in liquid measure.

Parts per billion (ppb): A measurement of concentration of one unit of material dispersed in one billion total units.

Parts per million (ppm): A measurement of concentration of one unit of material dispersed in one million total units.

Rinsate: Rinse water resulting from cleaning the insides of farm chemical containers or application equipment.

Secondary containment: Impermeable floor and walls around a fertilizer storage area that minimize the amount of fertilizer seeping into the ground from a spill or leak.

Wash water: Solution containing very low concentrations of farm chemicals resulting from cleaning the exterior of application equipment.

Improving Fertilizer Storage and Handling

Keeping Idaho's Water Clean

1. Fertilizer storage practices

When stored safely in a secure location, fertilizers pose little danger to ground water. Keep fertilizer dry and out of the way of activities that might rip open a bag or allow moisture to enter a bulk container.

Locate fertilizer storage areas downslope and at least 400 feet away from your well to provide reasonable assurance well water will not be contaminated. Separation from the well should be greater in areas of sand or fractured bedrock. Worksheet A, *Site Evaluation*, can assist you in ranking your homestead soils and geologic conditions by their ability to keep contaminants out of ground water.

Managing your existing storage facility

Compared to the cost of a major accident, or even a lawsuit, storage improvements can be a bargain. Your cheapest alternative may be to cut back on the amount of fertilizer you store. If that option is not practical, consider how you can protect the fertilizers you keep on hand.

- A locked storage area or building provides security by reducing the chance of accidental spills or theft. Use signs and labels to indicate that the area or building is for fertilizer storage.
- Sound containers are your first defense against a spill or leak. If a bag is accidentally ripped, confine the fertilizers to the immediate area and recover them promptly.
- Provide pallets to keep bags off the floor. Store dry products separate from liquids to prevent wetting from spills.
- If you plan to store large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container, plus the displaced volume of any other storage tanks. Contact the Idaho Department of Agriculture (IDA) at (208) 334-3550 for more detailed information.
- Store fertilizer separately from pesticides.

Ideally, your fertilizer storage area should be separate from other activities. If the building also serves as a machine shed or as housing for animals, you may find it difficult to meet all the requirements for safe storage.

Fires in a storage area can pose a danger to firefighters and to the environment. Reducing the fire risk in the storage area may be the first step, but other things can be done. You can reduce the damages by anticipating such emergencies. Label windows and doors to alert firefighters to the presence of fertilizer stored in the structure. If a fire should occur, consider where the water will go and where it might collect. A curb around the floor can help confine contaminated water. In

making the storage area secure, also make it accessible, allowing you to get fertilizers out in a hurry.

Building a new storage facility

While a new facility just for fertilizer storage may be expensive, it may be safer than trying to adapt areas meant for other purposes. Keep the principles in mind that were mentioned above. Safe storage can minimize the risk of accidents and spills around your fertilizer storage area.

In the event of an accidental spill, an impermeable (waterproof) floor, such as concrete, helps to prevent fertilizer seeping into the ground and leaching to ground water. A curb built around liquid fertilizer storage areas will prevent contaminants from spreading to other areas.

For bulk liquid fertilizer storage, secondary containment provides an impermeable floor and walls around the storage area, which will minimize the amount of fertilizer seeping into the ground if a tank should rupture or leak.

A properly designed mixing/loading pad can provide for collection of spills that may occur during the transfer of fertilizer to application equipment or nurse tanks. If you must store piles of dry bulk fertilizer, place them on an impermeable surface under cover or in a building. Treat dry fertilizer impregnated with a pesticide, as a pesticide. Store under cover or protect from rain. See *Fact/Worksheet* 2 for more information concerning pesticide storage and handling practices.

For information on factors to consider in designing a storage facility, such as ventilation, temperature control, and worker safety, contact the IDA (208) 334-3550 or your county Cooperative Extension System office or Extension Agricultural Engineer, (208) 885-7626, for plans and recommendations. Secondary containment draft rules are being developed by IDA.

2. Mixing and loading practices

Ground-water contamination can result from small quantities spilled regularly in the same place. Spills of dry fertilizer should be promptly and completely cleaned up and placed immediately into the application equipment. Cleaning up spills of liquid fertilizers can be much more difficult.

Better management of your existing mixing and loading site

Liquid fertilizer spills and leaks are bound to occur from time to time. Even if you don't have an impermeable mixing and loading pad, you can minimize contamination by following some basic guidelines:

- Avoid mixing and loading fertilizers near your well. One way to do this is to use a nurse tank to transport water or fertilizer to the field mixing and loading site. Ideally, the site should be moved from year to year within the field of application.
- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to sink quickly through the soil. A clay surface is better than sand or gravel.
- Install an anti-backsiphon device on the well or hydrants. Never put the hose in the applicator tank. Provide an air gap of six inches between the hose and the top of the applicator tank.
- Always supervise applicator filling.
- Consider using a closed handling system in which the fertilizer is directly transferred from the original container to the application equipment, such as by a hose.
- Use rinsate as part of current fertilizer application or mix with subsequent loads. Always apply fertilizer at recommended agronomic rates.

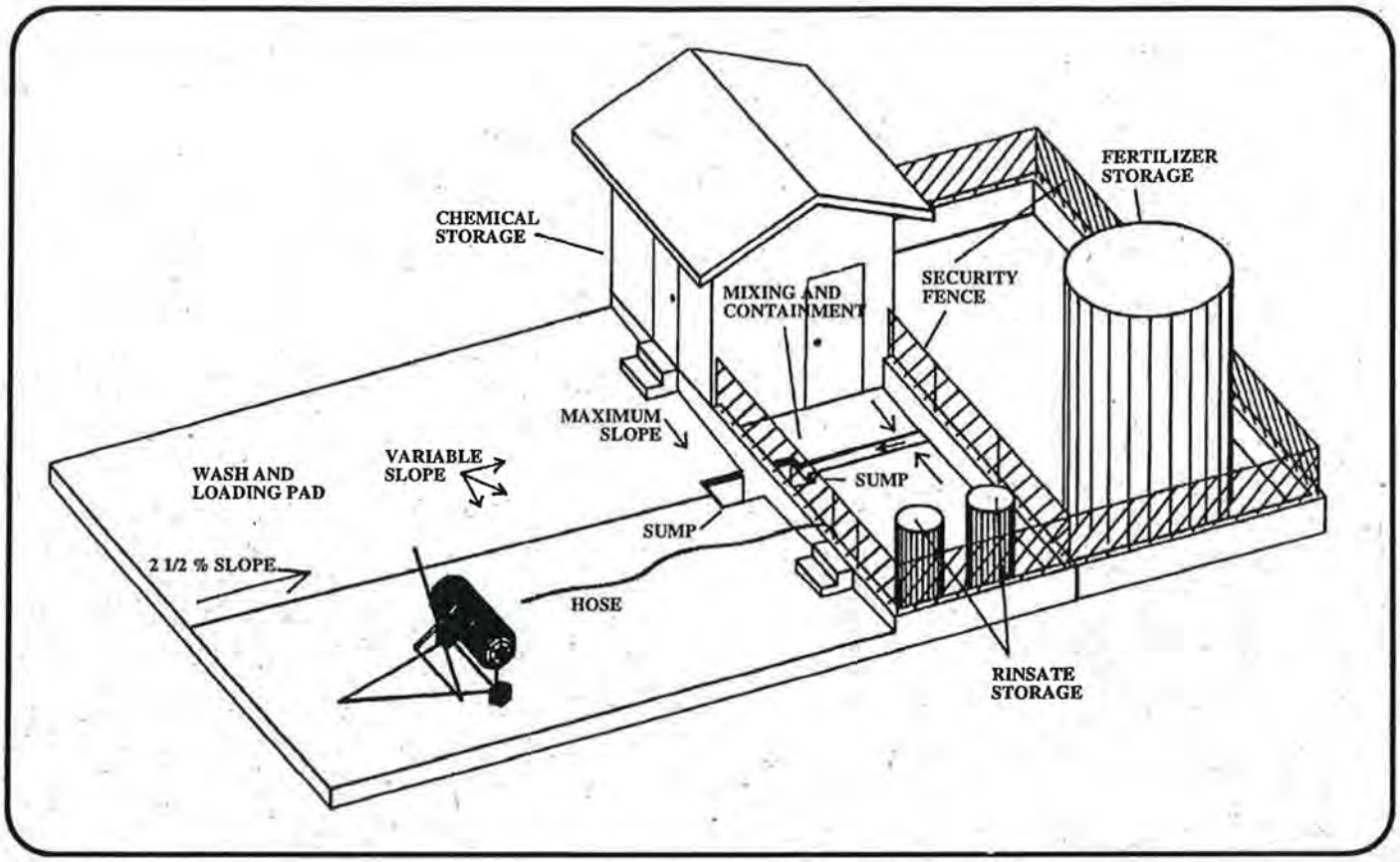

Figure 1: Farm-sized fertilizer facility. *Source: Modular Concrete Wash/Containment Pad for Agricultural Chemicals, by R.T. Noyes and D.W. Kammel. American Society of Agricultural Engineers Paper Number 891613.*

A liquid fertilizer mixing and loading pad

Containing liquid fertilizer spills and leaks requires an impermeable surface (such as coated or sealed concrete) for mixing and loading. A concrete pad should be large enough to accommodate your equipment and to contain leaks from bulk tanks, wash water, and spills from transferring fertilizers to the applicator (*Figure 1*).

Locate the pad adjacent to the storage area. At sites where runoff may occur, construct a diversion to direct runoff away from the well.

The size of the pad depends on the equipment you use. It should provide space around the parked equipment for washing and rinsing. The fertilizers and rinse water should drain to a collection area, such as a sump, for transfer to rinsate storage tanks. Having several separate rinsate storage tanks allows you to keep rinse water from different fertilizer chemical mixes separate. That way, it can be used for mixing water on subsequent loads.

If you are considering constructing a mixing/loading pad, more detailed information is available from county Cooperative Extension System offices or Extension Agricultural Engineer at (208) 885-7626.

3. Spill cleanup

For dry spills, promptly sweep up and use the fertilizer as it was intended. Dry spills are usually very easy to clean up. Dry pesticide-impregnated fertilizer is considered a pesticide and, if spilled, should be recovered and applied to the target crop as it was intended.

For liquid spills, recover as much of the spill as possible and use as it was intended. Some soils contaminated with fertilizer may be required to be removed and field applied at recommended agronomic rates.

Cleanup of a spilled or discharged dangerous waste or hazardous substance must be done immediately. If the person responsible for a spill or discharge is uncertain of its possible significance, notification and/or request for assistance from Idaho State Poison Control is encouraged. It is also expected that control and stabilization of a spill or discharge (e.g. shutting off an open valve or righting an overturned drum) would come first, provided that such activity could be done safely.

For dry spills, promptly sweep up and use the pesticide as it was intended. Dry spills are usually very easy to clean up. For liquid spills, recover as much of the spill as possible. Recovery in the original liquid form is recommended. Otherwise use soil, sawdust or other absorbent material, and place it in a sealable container. It may have to be disposed of as hazardous waste. Contact IDA, Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ), a hazardous waste contractor, or your local public health district for disposal procedures.

Spills are generally considered a threat to human health or the environment and should be reported immediately. Spills or discharges within containment structures that are cleaned up in a timely manner typically do not need to be reported. For example, shop floors, concrete pads, or drip pans could be considered barriers to the environment if they are able to prevent contact with the environment. Do not use containment structures to store or accumulate dangerous wastes.

Have an emergency response plan for the site. Know where the runoff water will go, how to handle your particular fertilizers, and whom to call for help.

For further information or assistance or to report spills, contact the nearest Poison Control (800) 632-8000, IDA, or one of the following DEQ 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

For an updated version of the Idaho Fertilizer Containment Rules, contact IDA at (208) 334-3550.

4. Container disposal practices

Bulk deliveries of anhydrous ammonia, liquid fertilizers, and dry fertilizers have reduced the need to dispose of containers. Many farmers do, however, use bagged fertilizers. Empty bags should be bundled and stored at least 400 feet away from your well, and disposed of properly, preferably in an approved landfill.

Your drinking water is least likely to be contaminated by your disposal practices if you follow appropriate management procedures. However, proper offsite disposal practices, such as disposal at an approved landfill, are essential to avoid risking contamination that could affect the water supplies and health of others.

5. Other management factors

Reducing fertilizer waste makes financial as well as environmental sense, but it means more than just reducing spills. It also means not buying more than you need to apply and keeping records of what you do have on hand. Buying only what you need makes long-term storage unnecessary.

Keeping records may seem like a task unrelated to ground-water contamination, but knowing what you've used in the past and what you have on hand allows you to make better purchasing decisions. Keep records of past field application rates and their effectiveness.

Worksheet 3

Fertilizer Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk rank for fertilizer storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE *(Addressed in Section 1)*					
Dry formulation					
Amount stored	None stored at any time.	Less than 1 ton stored.	Between 1 and 25 tons stored.	More than 25 tons stored.	____
Storage site	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Covered on clay soil. Spills are collected.	Partial cover on loamy soils.	No cover on sandy soils. Spills not collected.	____
Liquid formulation					
Amount stored	None stored at any time.	Less than 55 gallons stored.	Between 55 and 500 gallons stored.	More than 500 gallons stored.	____
Storage site	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Clay-lined secondary containment. Most of spill can be recovered.	Moderately permeable soils (loam). No secondary containment. Most of spill cannot be recovered.	Highly permeable soil (sand). No secondary containment. Spills contaminate soil.	____
Length of storage period	Less than 1 month	1 to 3 months	3 to 6 months	More than 6 months	____

Containment regulations being developed by IDA, regulatory trigger quantities will be determined, contact IDA.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE *(continued)*					
Location of storage area in relation to well location	400 feet or more downslope from well.	200 to 400 feet downslope from well.	100 to 200 feet downslope from well.	*Within 100 feet** **or** upslope from well.	____
Containers	Original containers clearly labeled. No holes, tears, or weak seams. Lids tight.	Containers aging. Poorly labeled or hard to read.	Containers patched. Metal containers showing signs of rusting. Labels missing.	Containers have holes or tears that allow fertilizers to leak. No labels.	____
Security	Fenced and locked **or** otherwise secured area separate from all other activities. Locks on valves.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill fertilizer.	Open access to theft, vandalism, and children.	____
Storage of other products and materials	Area dedicated for fertilizer storage.	Area shared with machinery storage.	Shared area with other farm chemicals.	Area of common use for animals and other chemicals.	____
MIXING AND LOADING PRACTICES *(Addressed in Sections 2 and 3)*					
Location of mixing/ loading area in relation to well	400 or more feet downslope from well.	200 to 400 feet downslope from well.	100 to 200 feet down-slope from well.	*Within 100 feet** **or** upslope from well.	____
Spill protection for dry materials	Protected from wind. Surface impervious with easy cleanup **or** loading in field of use.	Open area with easy cleanup.	Open area, cleanup a chore.	Graveled surface on sandy soil.	____
Spill protection for liquids	Sealed concrete pad slopes to collection point or sump that allows easy recovery of spill.	Loading in field of use. Change location each fill. Spills cleaned up promptly.	Flat concrete pad with some cracks. No curb or sump. Spills not cleaned up promptly.	No loading pad on porous soil. Same site each load. Spills not cleaned up.	____

* This practice represents a high risk choice.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER ***(continued)***					
Loading/filling supervision	Constant by trained individual.	Constant by whoever is handy.	Periodic.	Seldom or never. Occasional spills.	____
Water source	Separate water tank.	____	____	Obtained directly from water well, stream, or pond.	____
Backflow prevention on water supply	Anti-backflow device installed. Six-inch air gap maintained above sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. **Hose in tank below water line.**	____
Liquid handling system	Closed system for all liquid product transfers.	Closed system for most liquids. Some liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port hard to reach.	____
CLEANUP AND DISPOSAL PRACTICES *(Addressed in Section 4)*					
Container disposal	Returned to supplier, **or** reusable container.	Taken to approved landfill.	Disposal of empty containers on property.	Disposal of partially filled containers on property.	____
Application equipment cleaning and rinsate disposal	Application equipment rinsed in field. Rinsate applied to crop or pasture ground at agronomic rate.	Application equipment rinsed on pad at homestead. Rinsate applied to crop or pasture ground at agronomic rate.	Application equipment rinsed at homestead. Rinsate applied around yard. Not applied at agronomic rate.	Application equipment rinsed at homestead. Rinsate allowed to drain in one spot.	____

Boldface type: Besides representing a higher risk choice, this practice violates Idaho law.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Fertilizer Storage and Handling Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Amount of dry formulation stored				
Type of storage				
Amount of liquid formulation stored				
Type of storage				
Length of storage period				
Location of storage area in relation to well				
Containers				
Security				
Storage of other products and materials				
Location of mixing/loading area in relation to well				
Spill protection for dry materials				
Spill protection for liquids				
Loading/filling supervision				
Water source				
Backflow prevention on water supply				
Liquid handling system				
Container disposal				
Application equipment cleaning and rinsate disposal				

Step 2: Look over your rankings for individual activities.

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action . The long term goal of the **Home*A*Syst** program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References
Who to call about...

Plans and recommendations for fertilizer mixing and loading pads

• Your county Cooperative Extension System office or Cooperative Extension Agricultural Engineer, (208) 885-7626.

Fertilizer storage and containment rules

• Call IDA, (208) 334-3550.

Fertilizer spills and proper disposal of soil contaminated by a fertilizer spill

• Call IDA, DEQ, your local public health district, or emergency coordinator.

Health effects of nitrates in drinking water

• Contact the DEQ, local public health district, or the IDA (208) 334-3550. This is the department's general information contact for all health related issues.

Drinking water quality and treatment

• EPA Safe Drinking Water Hotline, Monday through Friday, 6:30 a.m.– 3 p.m. Pacific Standard Time, call (800) 426-4791, or the DEQ.

• The reporting numbers for the DEQ regional offices are:

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

What to read about...

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.

Ground-water contamination, protection, and testing

- Quality Water for Idaho: Nitrate and Groundwater - CIS 872 (1)
- Quality Water for Idaho: Water Testing - CIS 873 (1)
- Idaho's Water Resources - CIS 887 (1)
- Quality Water for Idaho: Groundwater In Idaho - CIS 900(1)
- Best Management Pracitices for Nitrogen Management to Protect Surface Water - CIS-962 (1)
- A list of laboratories certified to conduct water sample analyses is available from your Cooperative Extension System agent or local health district.

Health effects

- The product label. Read your product labels carefully for specific information on fertilizer health effects.
- *Nitrates and Groundwater: A Public Health Concern.* Freshwater Foundation. (4)

Fertilizer storage, handling, disposal, and safety

- *Designing Facilities for Pesticide and Fertilizer Containment.* Midwest Plan Service. MWPS-37. (2)
- *Constructing an Inexpensive Ag Chemical Rinse Pad.* ACRE fact sheet 14. (5) Discusses capturing wastewater, storage of chemicals, site selection, and the design of a simple rinse pad.
- *Disposing of Crop Protection Chemical Containers. ACRE* fact sheets, 5 and 12. (5) Fact sheet 5 provides an eight-point checklist of procedures to follow for safe disposal of chemical containers. Fact sheet 12 discusses pressure-rinsed and triple-rinsed containers and rinsed container disposal.
- *Chemicals in Your Community: A Guide to the Emergency Planning and Right To Know Act.* 1988. U.S. Environmental Protection Agency. (3) Pages 26-27 contain information on implications of this law for farmers.

Publications available from...

- Your county Cooperative Extension System office. There may be charges for the publications, postage, and sales tax.
- Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.
- U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs (S-766C), 401 M Street S.W., Washington, D.C. 20460.
- Freshwater Foundation at Spring Hill Center, 725 County Road 6, Wayzata, Minnesota, (612) 449-0092.
- Alliance for a Clean Rural Environment (ACRE), P.O. 413708, Kansas City, Missouri 64141, (800) 545-5410.

NOTES

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Petroleum Product Storage

Fact/Worksheet 4

Keeping Idaho's Water Clean

Why should I be concerned?

Above ground and underground storage of liquid petroleum products such as motor fuel and heating fuel presents a threat to public health and the environment. According to the U.S. Environmental Protection Agency, nearly one out of every four underground storage tanks or piping systems in the United States may now be leaking. For an underground petroleum tank more than 20 years old, the potential for leaking increases dramatically, particularly if it's not protected against corrosion. Newer tanks and piping can also leak, especially if not installed properly.

A small gasoline leak of one drop per second can result in the release of about 400 gallons of gasoline in one year. This released gasoline may enter the ground water, where even a few quarts may be enough to severely pollute a homestead's drinking water. At low levels, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health.

Since pesticides get more media attention than fuel contaminants, the common perception is that they pose a more significant health risk. However, petroleum fuels contain a number of potentially toxic compounds as well, including common solvents such as benzene, toluene, and xylene, and additives such as ethylene dibromide and organic lead compounds. Benzene, considered a human carcinogen, has a ground-water standard much like that of many pesticides at five parts per billion.

Preventing tank spills and leaks is especially important because of how rapidly gasoline, diesel, and fuel oils can move through surface layers and into ground water. Vapors from an underground leak that collect in basements, sumps, or other underground structures have the potential to explode. Selling property with an old underground tank may also be difficult.

This worksheet focuses on storage of gasoline, kerosene, and liquid heating fuels, as well as any related piping. It does not apply to above-ground LP (liquid propane) gas, because leaks vaporize quickly and do not threaten ground water.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my ground water?

- It will take you step by step through your petroleum product storage practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your petroleum product storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 9. It should take you about 15 to 30 minutes to complete this worksheet and figure out your risk ranking.

Glossary

Petroleum Product Storage

These terms may help you make more accurate assessments when completing Fact/Worksheet 4. They may also help clarify some of the terms used.

Cathodic protection: One of several techniques to prevent corrosion of a metal surface by reversing the electric current that causes corrosion. A tank system can be protected by sacrificial anodes or impressed current (See **sacrificial anodes** and **impressed current**).

Certified installer/remover: A person certified by the state to install, repair, or remove petroleum storage tanks.

Corrosion: Deterioration of a metallic material ("rust") due to a reaction with its environment.

Corrosion protection: Measures taken to prevent corrosion on a steel tank.

Galvanized: The result of coating an iron or steel structure with zinc. Galvanized materials do not meet corrosion protection requirements for underground tanks.

Impressed current: A protection system that introduces an electric current into the ground through a series of anodes that are not attached to the underground tank. Because the electric current flowing from these anodes to the tank system is greater than the corrosive current attempting to flow from it, the underground tank is protected from corrosion.

Interior liner: A tank liner made of noncorrosive synthetic materials that are effective in preventing leaks in metal tanks when they corrode.

Inventory control: Measuring and comparing the volume of tank contents regularly with product delivery and withdrawal records to help detect leaks.

Protected tank: A tank approved by the underground storage tank regulatory authorities for use underground if installed according to the manufacturer's instructions. An **unprotected** tank has not been installed to the manufacturer's instructions.

Regulated tank: A tank, which because of its size, use and/or location, requires registration with a state or local agency. Not all tanks are subject to regulation.

Sacrificial anodes: Pieces of metal attached directly to an underground tank to prevent corrosion. Sacrificial anodes deflect corrosion-causing electrical currents from the underground storage tank.

Secondary containment: A system designed to catch and hold the contents of a tank if it leaks or ruptures.

Soil permeability: Characteristic of a soil to transmit water or air. Slowly permeable soils have fine-textured materials (clays) that permit only slow movement. Moderately or highly permeable soils have coarse-textured materials (sands) that permit rapid movement.

Spill and overfill protection: Spill protection usually consists of a catch basin for collecting spills when the tank is filled. Overfill protection is a warning which helps prevent an overfill, such as an automatic shutoff or buzzer. These precautions can prevent the pollution of the ground water.

Tank tightness testing: A procedure for testing a tank for leaks to identify any accidental release of any stored substance into the environment, or intrusion of ground water into an underground tank.

HOME* A* SYST

Keeping Idaho's Water Clean

Improving Petroleum Product Storage

1. Storage tank location

The distance between your liquid petroleum storage tank and your drinking water well is vitally important to reducing the risk of ground-water contamination. Petroleum storage tanks should be located at least 50 feet from a public water well according to state regulations. Existing wells are required by law to meet separation requirements in effect at the time they were constructed. Make every effort, however, to exceed the regulations whenever possible.

One gallon of gasoline containing one percent benzene can contaminate about two million gallons of ground water. Preventing spills and leaks is especially important because gasoline can move quickly through the soil. Although diesel fuel and fuel oil are more dense than gasoline and move more slowly through the soil, they too will eventually reach ground water.

Every site has unique geologic and hydrologic conditions that can affect ground-water movement. Petroleum products reach ground water more quickly if local soil is permeable. Sands and gravels are examples of permeable soils. Figure 1 illustrates petroleum product seepage into soils. It is preferable to locate a new tank at least 200 to 400 feet away from your well or your neighbor's well, to provide reasonable assurance that subsurface flow or seepage of contaminated ground water will not reach your well. If possible, the tank should also be located downslope from the well.

Regulations for siting above ground storage tanks are concerned more with the explosion potential of tanks than the ground-water pollution potential. To protect against explosion and fire, follow local siting regulations. Following state and federal regulations and recommendations can better protect the ground water supplying your well.

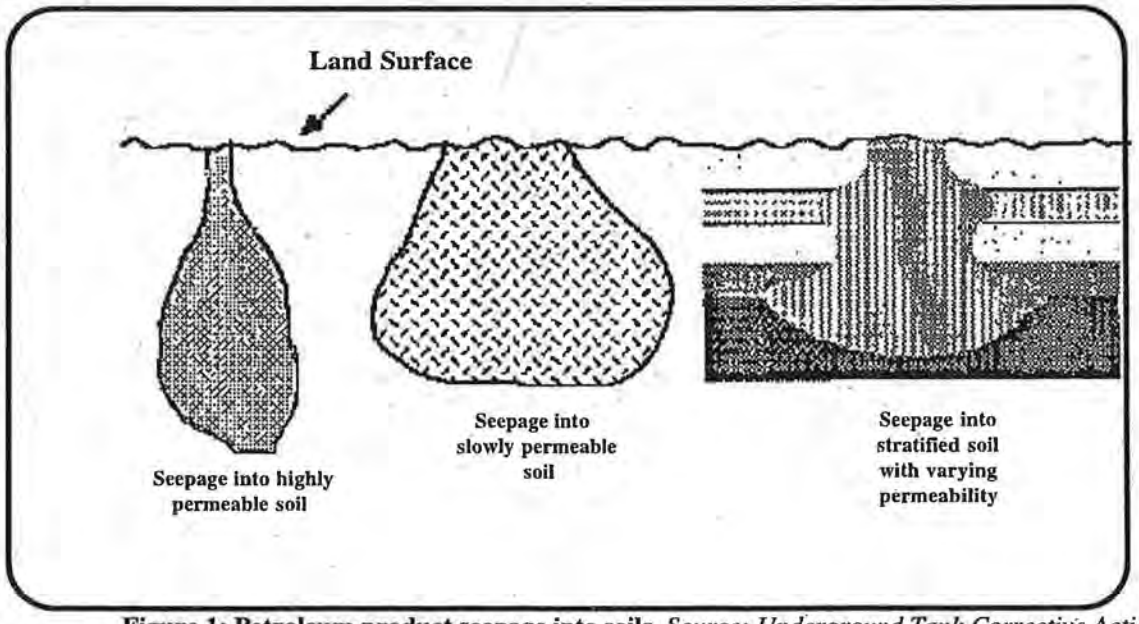

Figure 1: Petroleum product seepage into soils. *Source: Underground Tank Corrective Action Technologies, EPA/625/6-87-015, January 1987.*

New storage tank location

In addition to maintaining an adequate distance from your drinking water well or neighbor's well, choose a location for a new tank based on the following considerations:

- **Soil characteristics.** New underground storage tanks are required to be installed using backfill materials recommended by the manufacturer. Use clean backfill during installation to decrease the negative effects of surrounding soils. Highly corrosive clays, wet soils, and acid (low pH) soils can significantly speed up the rate of corrosion of unprotected underground metal tanks and piping.

- **Soil stability.** Assess the ability of the underlying soil to support both underground and above ground tanks. Properly anchor tanks in special locations, such as hillsides. Be sure that pipes cannot twist or break if the tank is bumped or disturbed.

- **Depth to groundwater.** Floodways or areas where the water table is close to the surface are poor locations for storage tanks. Tanks placed in such areas require special installation. To reduce pollution potential, an above ground tank may be preferable to an underground tank in these situations.

- **Current and previous land use.** Sites that contain abandoned pipes and tanks, agricultural drainage tiles, or waste materials pose special installation problems. Any metal already in the ground at your chosen site will increase corrosion rates for the unprotected tank.

- **Traffic.** Assess traffic patterns around the tank. Determine whether the location of the tank or dispenser will block movement of farm vehicles during refueling or cause special problems if any work needs to be done on the tank. Protect the tank and piping from collisions with farm and fuel vehicles.

2. Tank design and installation

Whenever you install a fuel storage tank, carefully follow the manufacturer's recommended practices for installation. Proper installation is one way to minimize the leaking potential of the tank or the piping connected to it. Scratches on a metal tank that were caused by careless installation can increase corrosion and tank deterioration.

Most underground storage tanks with more than 1,100 gallons capacity (except tanks with heating oil which is consumed on site) must be registered with the Division of Environmental Quality (DEQ). Registration of new underground storage tank installations must be filed with the DEQ within 30 days of bringing such tank into use. Underground tanks are not designed to be used above ground, and are unsafe for such use.

Underground tanks

Federal law requires that new regulated underground petroleum storage tanks and all related piping used on a rural homestead must be constructed of approved materials such as fiberglass or steel with corrosion protection. A tank is considered to be "underground" if ten percent or more of the volume, including the pipes, is below the surface of the ground. **All regulated existing underground tanks and metallic product lines must have corrosion protection by December 23, 1998, if they are to remain in use.** Corrosion protection systems must be designed by a corrosion expert. Even if your tank system is not covered by these regulations, it is important that these design standards be followed.

Corrosion and its prevention

Corrosion (rust) is the deterioration of a metallic material due to a reaction with its enviroment. Corrosion damage to tanks is caused when a metal underground tank and its underground surroundings act like a battery. Part of the tank can become negatively charged, and another part positively charged. Moisture in the soil provides the connecting link that finally turns these tank "batteries" on. Then the negatively charged part of the underground tank system, where the current exits from the tank or its piping, begins to deteriorate. As electrical current passes through this part, the hard metal begins to turn into soft ore, holes form, and leaks begin.

Steel underground tanks can be protected from corrosion if they are bonded to a thick layer of noncorrosive material, such as **fiberglass reinforced plastic**. Also, the corrosion problem can be entirely avoided by using tanks made of noncorrosive material, such as fiberglass.

Other methods of corrosion protection include cathodic protection systems (sacrificial anodes) or internal lining.

- A **sacrificial anode** is a special material connected to the tank that is more electrically active than the steel tank. Because the anode is more active, electric current runs from the anode rather than from the tank. The tank becomes the cathode (positive electrode) and is **protected** from corrosion. The attached anode (negative anode) is "sacrificed" or consumed in the corrosion process. This method should only be used on new steel tank installations. Corrosion protection experts generally agree that sacrificial anodes do not work effectively or economically with most existing steel underground storage systems.

- **Interior liners** are made of noncorrosive synthetic materials and can also be effective in protecting metal tanks. Liners must be internally inspected according to regulations or combined with a cathodic protection system.

- **Impressed current** (*Figure 2*) is a corrosion protection system that introduces an electric current through a rectifier into the ground through a series of anodes that are not attached to the underground storage tank (UST). This current is sent through an insulated wire to the anodes, then flows through the soil to the underground tank system, and returns to the rectifier through an insulated wire attached to the UST. The UST system is protected because the current going to the UST system overcomes the corrosion-causing current normally flowing away from it.

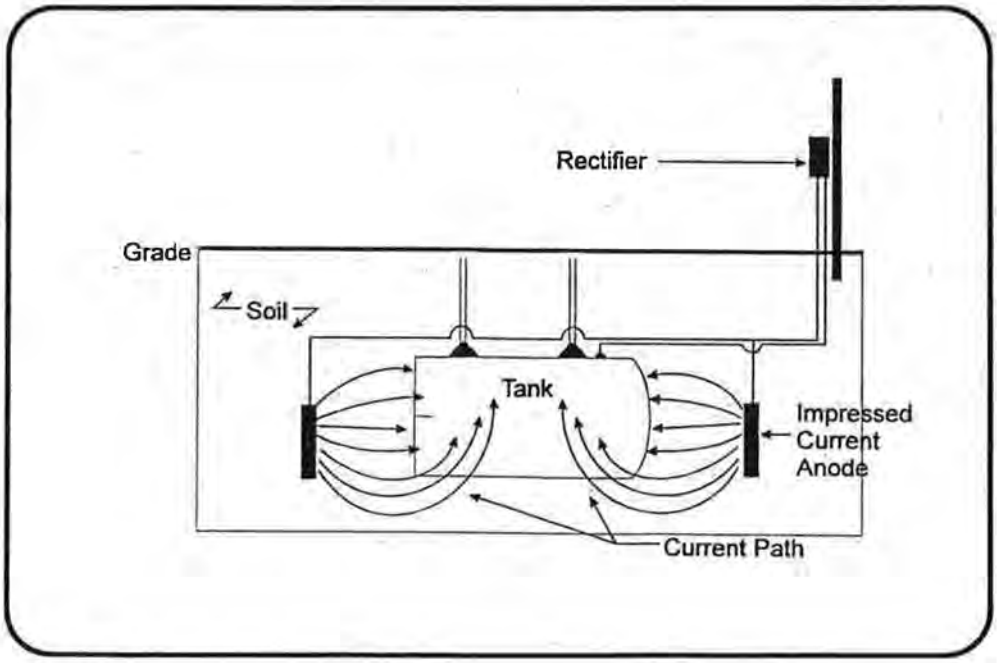

Figure 2

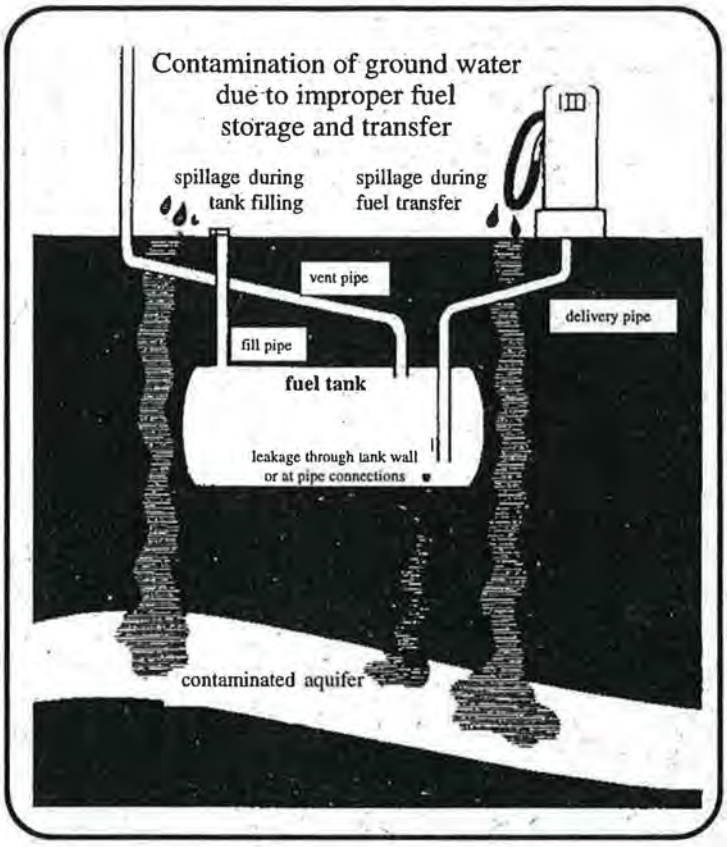

Figure 3: Contamination of ground water due to improper fuel storage and transfer.
Source: Handling and Underground Storage of Fuels, Cooperative Extension Service, Michigan State University, Extension Publication WQ01. Reprinted February 1986.

Spill/Overfill prevention

Federal law requires that all new farm and residential underground tanks designed to hold 1,100 gallons or more (other than heating oil) have spill and overfill protection. Spill protection typically consists of a catch basin for collecting spills when filling the tank. Overfill protection is a warning or prevention of an overfill and must either automatically shut off the flow of product when the tank is 95 percent full or alert the operator when the tank is 90 percent full. Spill and overfill protection are important and relatively inexpensive; they can prevent a number of small releases over a long period of time from polluting the ground water. Figure 3 shows how ground water can be contaminated by underground tank systems.

Above ground tanks

Regulations for above ground tank installation seek to reduce the potential for fire. To decrease ground-water pollution potential, place farm tanks within a secondary containment. Secondary containment can be a double-walled tank or a structure consisting of a dike and a pad. Piping should be made of cathodicly protected steel, coated to prevent corrosion.

Above ground tanks and their installation are affected by a mosaic of local and federal regulations. The manufacturing of above ground tanks is self-regulated by the industry, with oversight provided by Underwriters Laboratories (UL). Industry standards for above ground storage tanks are detailed in UL 142. The best source of information on proper siting and installation of above ground storage tanks are local authorities, especially the local fire chief or State Fire Marshal.

3. Monitoring

Rules for regulated underground tanks require that tanks have a method of detecting leaks. Select the tank location carefully to ensure ease of installation and reliability of chosen leak detection methods. Test the tank periodically for leaks, and measure the tank inventory to help detect leaks before major problems develop.

Inventory control must be performed every operating day for underground systems which store and dispense fuel on a regular basis. While inventory measurement will not detect very small leaks, it will at least provide a warning that further investigation may be necessary.

Since cleanup of fuel leaks is always costly and often not totally effective, it is important to constantly monitor underground tanks containing petroleum products. If you have an underground petroleum storage tank on your property, be especially aware of the age of your tank as well as the need to establish a leak detection program.

Most existing tanks used on homesteads are bare steel. Because of this, tank or piping corrosion problems will eventually cause leaks. If your tank is more than 10 years old or if you don't know its age, make a special effort to determine whether leaks exist.

Existing regulations and good practice require that you use a method to detect leaks regularly. Release detection requirements can be met by a combination of annual tightness testing and inventory control, or through either automatic tank gauging, soil vapor monitoring, or other approved methods. Copies of the actual regulations, as well as release detection requirements and methods, are available by contacting DEQ at (208) 373-0502, or the DEQ regional office for your area (see *Contacts and References* section).

Protection of the ground-water resource is the most important consideration of a leak detection system. The closer the tank is to the homestead's drinking water well, the more important it is to ensure that an adequate leak detection system is in place.

Leaks and spills

If you find a leak or spill from an underground storage tank, state law requires that you notify the DEQ regional office for your area. First, contact your local fire department then take whatever actions are necessary to remedy the problem. Follow recommendations you receive when you report the spill or leak.

A leak or spill from an above ground storage tank is generally dealt with by a designated local emergency management agency, such as the fire department. Contact your local fire district and DEQ in case of an above ground leak or spill.

If your storage tank holds oil and has the "reasonable" potential to leak into navigable waters of the United States (e. g., Snake River), you may be required by the Environmental Protection Agency (EPA) to have a Spill Prevention Control and Countermeasure Plan (SPCC). An above ground storage tank with a capacity greater than 660 gallons, an above ground facility with a capacity greater than 1,320 gallons, or an underground storage tank with a capacity greater than 42,000 gallons must have an SPCC.

4. Insurance

Federal law requires that certain underground storage tank owners obtain pollution liability insurance so that releases can be cleaned up in a timely manner. Contact the Petroleum Storage Tank Fund at (208) 334-2370 for more information about the state sponsored program that can help you meet this requirement.

5. Underground tank removal and closure

Tanks that are no longer in use can cause problems for owners and operators many years later. They will continue to corrode and, if they still contain gas or oil, will likely contaminate ground water.

Try to determine the location of any unused tanks on your property. Also try to find out whether the tanks still hold materials or have holes. These tanks must be pulled from the ground and disposed of, or closed in place. Check to see if local ordinances prohibit the in-place closure of buried storage tanks before deciding which option to pursue.

State law requires that only certified removers pull or close in-place farm and residential regulated tanks with over 1,100 gallons capacity, unless the owner does all work and follows industry standards. An environmental site assessment is required, and DEQ must be notified 30 days before any regulated tank can be removed or closed in place. As part of the underground storage tank removal process, all associated buried piping should be removed.

In addition, notify your local fire department at least 30 days before pulling or closing any petroleum tank. This will ensure that precautions are taken to prevent an explosion or other problem. Deaths have occurred due to improper closure or pulling of a tank. The importance of safety during removal or closure should not be overlooked.

You should document steps you take to legally close your tank — including notifying DEQ that the tank has been closed — so that you are protected from legal action.

Any questions regarding underground storage tank removal or in-place closure should be directed to DEQ (208) 373-0502 or to the DEQ regional office for your area (see *Contacts and References* section).

Worksheet 4

Petroleum Product Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete section "What do I do with these rankings?"
5. Allow about 15–30 minutes to complete the worksheet and figure out your risk ranking for petroleum product storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION *(Addressed in Section 1)*					
Position of tank in relation to drinking water well	Tank more than 400 feet downslope from well.	Tank less than 400 feet, but more than 150 feet downslope from well.	Tank less than 150 feet, but more than 50 feet downslope from well.	Tank less than 50* feet or upslope from well.	____
Site characteristics of tank location **Soil type:**	Medium- or fine-textured soils (silt loam, loam, clay loams, silty clay) with low permeability.**	Medium- or fine-textured soils with moderate permeability.**	Coarse-textured soils (sand, sandy loam) with moderate-permeability.**	Coarse-textured soils with high permeability.**	____
Water table depth:	Greater than 99 feet	50-99 feet	20-49 feet	Less than 20 feet	____
DESIGN AND INSTALLATION *(Addressed in Section 2)*					
Type and age of tank/ corrosion protection *(Underground tanks)*	Double-walled tank.	Single walled steel tank with cathodic protection or fiberglass tank.	Unprotected single walled steel tank equal to or less than 10 years of age.	Unprotected single walled steel tank greater than 10 years of age.	____
Above-ground tanks	Doubled-walled tank placed within concrete or synthetic dike with pad able to hold 110 percent of tank capacity. UL 142 labeled.	Tank placed within dike and pad lined with low permeability soils,** able to hold 110 percent of tank capacity. UL 142 labeled.	Tank placed on pad with no dike. UL 142 labeled.	No secondary containment. Not UL 142 labeled.	____

*Illegal for new public water supply well installation. Existing wells must meet separation requirements in effect at time of construction.
**Low permeability soils like clay allow water to flow through slowly. High permeability soils like sand and gravel allow much faster water movement.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
DESIGN AND INSTALLATION (*continued*)					
Underground piping	FRP* **or** steel piping with cathodic corrosion protection. Isolated from tank, sloped back to tank **and** suction system with check valve at pump. Double-walled pipe.	Metal pipe with suction system. Pipe drains back to tank. Check valve at pump.	Metal pipe with suction system. Pipe drains back to tank. Check valve at tank.	Piping and tank of dissimilar materials. Pipe cannot drain freely to the tank. Single-walled, pressurized pipe system.	_____
Above-ground piping	Steel pipe with anti-siphon protection and bumper guards.	Steel pipe with anti-siphon protection.	Metal pipe and hose.	Nonmetal pipe.	_____
Tank installation	*Underground tank*-installed by state-certified installer. *Above-ground tank*-inspected by appropriate authority.	Installed according to recommendations supplied with new tank by seller.	Installed without consulting guidelines for given application.	Installed without backfill, setback, secondary containment, anchors, and other protections, or by untrained individual. No information on installation.	_____
Spill and tank overfill protection	Designed spill containment. Overfill alarm with automatic shutoff.	Designed spill containment. Overfill alarm **or** automatic shutoff.	Either designed spill containment or overfill protection.	No protection.	_____
Above-ground tank security enclosure	Tank surrounded by enclosure as required by Uniform Fire Code.	Tank surrounded by fence with lock.	Tank surrounded by fence. No lock.	No enclosure.	_____

* Fiberglass reinforced plastic.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
MONITORING *(Addressed in Section 3)*					
Tank integrity testing and leak detection monitoring	Active leak detection system in place.	Regular inventory control and annual tank tightness testing.	Occasional inventory control and annual tank tightness testing.	No inventory control, testing, or monitoring.	____
UNDERGROUND TANK REMOVAL AND CLOSURE *(Addressed in Section 5)*					
Unused underground tank	Tank taken from ground according to regulations and by a state certified remover. Excavation checked for evidence of contamination and any contamination reported to the state.*	Tank contents emptied and tank filled with inert material. Any contaminated material around site removed.*	Tank removed or filled with inert material. Excavation and site not checked for contamination.	Tank not properly removed, or improperly abandoned in-place.	____

* Petroleum releases are to be reported to the Division of Environmental Quality within 24 hours. Cleanup action may or may not be required depending on the type and extent of the release.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Petroleum Product Storage Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Position of tank in relation to well				
Site characteristics of tank location: Soil type:				
Water table:				
Type and age of tank, corrosion protection				
Above-ground tanks				
Underground piping				
Above-ground piping				
Tank installation				
Spill and tank overfill protection				
Above-ground tank security enclosure				
Tank testing and leak monitoring				
Unused underground tank				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any categories ranked in the shaded areas should be carefully reviewed. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References
Who to call about...

Underground storage tank registration, reporting closure and changes in tank ownership, and general information:

• Idaho Division of Enviromental Quality (DEQ) (208) 373-0502.

Above ground storage tank siting and installation

• Contact your local fire department or State Fire Marshal (208) 334-4370 for information on proper siting and installation of above ground tanks.

Environmental Protection Agency regulations

• U. S. EPA Region X, (800) 424-4372 or Idaho Operation's Office (208) 334-1450.

Petroleum storage tank insurance

• Contact Petroleum Storage Tank Fund (208) 334-2370.

Petroleum product spills from underground storage tanks

• Releases from underground storage tanks must be reported to the appropriate DEQ regional office within 24 hours. The reporting numbers for the regional offices are:

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

Effects of gasoline-contaminated ground water

• U.S. Environmental Protection Agency's Safe Drinking Water Hotline. Call toll free, (800) 426-4791 from 6:30 a.m. to 3:00 p.m. Mountain Standard Time.

Fire protection

• Contact your local fire department or State Fire Marshal (208) 334-4370.

What to read about...

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses for the source of each publication.

Ground water contamination, protection, and testing

• *Idaho Cleanup Requirements for Petroleum Contaminated Soil,* Idaho UST Information Series: #1. (2)
• *Idaho Petroleum Release Response and Corrective Action Requirements,* Idaho UST Information Series: #2. (2)
• *Guidelines for TPH Analysis of Petroleum Contaminated Soils,* Idaho UST Information Series: #5. (2)
• *Protocol for Sampling and Analysis of Used Oil,* Idaho UST Information Series: #6 (2)

Tank design, installation, and site selection

• *Recommended Practices for Installation of Underground Liquid Storage Systems.* 1994. Petroleum Equipment Institute, PEI/RP 100-94. $15, includes shipping. (4) Eleven-chapter technical document, including detailed steps and diagrams, covering such areas as material handling, release detection, cathodic protection, and testing and training.

• *Recommended Practices for Installation of Aboveground Storage Systems at Motor Vehicle Fueling Sites*, 1992. PEI/RP 200-92. $15, plus shipping. (4)

• *Storage and Dispensing of Flammable and Combustible Liquids on Farms and Construction Projects*, Uniform Fire Code, Article 79, Division 10. The Uniform Fire Code was developed by the International Fire Code Institute and has been adopted by most western states as the state fire code.

• *UL (Underwriter's Laboratory) 142: Standard for Safety. Steel: Aboveground Tanks for Flammable and Combustible Liquids.* Details the UL design standard for above-ground storage tanks. A copy of the standard can be obtained for a fee from UL by calling (708) 272-8800.

Tank regulations, testing, closure, and financial responsibilities

• *Musts for USTs: A Summary of New Regulations for UST Systems.* (2, 3)
• *Dollars and Sense: A Summary of Financial Responsibility for UST Systems.* (2, 3)
• *Unused Underground Residential Heating Oil Tanks,* Idaho UST Information Series: #8 (2)
• *Don't Wait Until 1998: Spill, Overfill, and Corrosion Protection for Underground Storage Tanks. (2,3)*
• *Straight Talk on Tanks: Common Questions on Leak Detection (2)*
• *Doing Inventory Control Right: For Underground Storage Tanks (2,3)*
• *Manual Tank Gauging: For Small Underground Storage Tanks (2,3)*
• *Recommended Practices for Site Assessments During Closure of Underground Storage Tanks Containing Petroleum, Idaho UST Information Series: #3 (2)*
• *Permanent Tank Closure, Idaho UST Information Series: #4 (2)*

Spanish language

• *Normas Y Procedieentos Para TSA. (3)*

Publications available from...

• Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
• Division of Environmental Quality, Underground Storage Tank Program, 1410 N. Hilton, Boise, Idaho 83706, (208) 373-0260.
• U.S. Environmental Protection Agency-Region X, 1200 6th Ave., Seattle, Washington, 98101, (800) 424-4372.
• Petroleum Equipment Institute, P.O. Box 2380, Tulsa, Oklahoma 74101, (918) 494-9696.

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Farm and Home Waste Management

Keeping Idaho's Water Clean

Fact/Worksheet 5

Why should I be concerned?

Consider the variety of products commonly used around the homestead — paints, solvents, oils, cleaners, wood preservatives, batteries, adhesives and pesticides. Also consider the amount of these products which go unused or are thrown away. Some common disposal practices can create an unsafe environment around the home and may contaminate ground water.

Small, unusable amounts are often spilled, buried, dumped, or flushed onto rural property. Improper use of some products may cause toxic health effects. Improper storage may allow chemicals to leak, causing potentially dangerous chemical reactions, toxic health effects, or ground water contamination. Improper disposal can allow chemicals to enter directly into drinking water through surface or ground water.

Your drinking water is least likely to be contaminated by hazardous wastes if you minimize the amounts of these substances you use on your homestead and follow proper disposal practices. Buy only the products you need. Use up, reuse, or recycle products whenever possible. Use, store, and dispose of them properly. Proper disposal practices are essential to avoid contamination that could affect the water supplies and health of your family and neighbors.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your waste management practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your waste management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete this worksheet and summarize your risk rankings.

Information derived from Home*A*Syst worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. It is not the intent of this educational program to keep records of individual results.

Glossary

Farm and Home Waste Management

These terms may help you make more accurate assessments when completing Fact/Worksheet 5. They may also help clarify some of the terms used.

Acutely hazardous waste: Those wastes designated by EPA as extremely hazardous because of their greater threat to human health and the environment.

Approved landfill: A waste disposal site specifically designed to protect ground water that meets current state standards.

Conditionally exempt small quantity generator: A hazardous waste generator who generates less than 220 lbs. of hazardous waste per month and less than 2.2 lbs. of acutely hazardous waste, and never accumulates or stores more than 2,200 lbs. of hazardous waste.

Dump: A local or on-farm solid waste disposal area that does not meet regulations, is not covered, is not designed to prevent leaching, and offers little ground water protection.

Hazardous waste: Any solid waste with certain properties that could pose dangers to human health or the environment (such as spent solvents, ink sludges, or cyanide wastes). This term is federal in origin, and covers all wastes the U.S. Environmental Protection Agency considers hazardous.

Household hazardous waste collection program: A special program in which a community collects waste for reuse, recycling, or shipment to disposal in a specially constructed hazardous waste landfill or destruction in an approved incinerator.

Incinerator: A combustion device specifically engineered to burn solid waste. Incinerators should be approved by the appropriate authority.

On-farm disposal: Any method of burning, dumping, or land spreading of wastes on the farm. Also includes use of the septic system for disposal. These are not recommended practices for disposing of hazardous waste.

Recycling: Reusing or reclaiming a waste material.

Solid waste: Any discarded material (solid, liquid or gas) that has been abandoned, is naturally waste-like, is stockpiled before recycling, or is used in a manner constituting disposal (such as application of oil for dust control).

Improving Farm and Home Waste Management

Keeping Idaho's Water Clean

Waste doesn't just go away; it enters the environment, with some wastes eventually entering ground water. Good management of the wastes around your farm and home can help protect the quality of your family's drinking water supply.

1. General philosophy for managing farm and home wastes

• **Buy with care.** Purchase only those items you need in amounts you can use, and use as few hazardous products as possible.

• **Try to use less hazardous products.** Contact the Idaho Department of Health and Welfare Division of Environmental Quality (IDHW-DEQ) or local government for information suggesting product substitutes that are less harmful to both human health and the environment.

• **Try to use up products and use them safely.** This is the best way to minimize waste and protect your water supply.

• **Recycle or reuse.** Many of the items used around the farm and home can be recycled or reused by either yourself or someone you know. Take advantage of the recycling centers to which you have access and don't be afraid to give some products away. Items which may be waste to you might be useful to someone else. Instead of throwing away usable or repairable items, give them to a friend, organization, or business that can use them.

• **Know the sources of hazardous waste.** Know which products around your farm and home are potential contaminants of the environment and ground-water supplies so that you can manage their use and disposal. This will allow you to better protect your family's drinking water supply.

• **Follow safe disposal practices.** Following the recommendations for solid and hazardous waste disposal as described in these materials sets can help minimize the risk these wastes present to your family's drinking water supply.

2. Homestead waste

In rural locations, most wastes are disposed of on site. Common disposal methods include burning or simply piling or burying trash in a ditch on the "back 40." Waste disposed of in an open dump, or even underground, can take many years to degrade or breakdown. Hazardous wastes in a dump can move down through the soil and contaminate the ground water you drink, or can be washed into surface water bodies.

To minimize the pollution potential from farm, household, and shop wastes and activities, minimize the amount of wastes you produce, especially hazardous wastes. Examine your

activities that involve use of hazardous materials to make sure that you really need all the products you are using. Carefully consider how to use the products safely, recycle or reuse them when possible, and dispose of used or remaining products in a way that will not pose a risk to surface or ground water. A few simple management principles apply in every situation:

- Use hazardous products away from your well (at least 200 to 400 feet), even when all your spills and drips will be contained.
- Return excess product, spills, or drips to the original activity. For example, contain oil or grease drips and use for future lubrication needs, and apply pesticide container rinse water according to label directions for the pesticide.
- Contain any unusable wastes, spills, and drips for appropriate disposal.
- Take uncontaminated recyclables to a recycling facility if one is available.
- Never dispose of wastes in or around abandoned wells.

When solid waste generated on the homestead is disposed of in an approved manner, there is less likelihood of contaminating ground water. Pay attention to all state and local regulations when managing wastes on your site.

All household and some farm hazardous wastes are excluded from waste management regulations. However, you are not exempt from liability for damages arising from waste that is improperly disposed. Any farm operation that produces more than 220 lbs. of hazardous waste per month, or more than 2.2 lbs. of acutely hazardous waste, or accumulates (stores) more than 2,200 lbs. at any one time, is subject to state hazardous waste regulations.

Drain cleaner, oven cleaner, furniture polish, spot removers, and disinfectants are just a few household products which can contribute to hazardous waste. Disposal of hazardous cleaners and home maintenance products should be limited as much as possible. All household cleaners should be used per their instruction labels. Give excess, unwanted household chemicals to someone who can use them, or dispose of them at a household hazardous waste collection event. Do not dispose of hazardous cleaners "down the drain." It may interfere with proper functioning of septic tanks or sewer treatment and contaminate soil and/or ground water (drainfield).

Open burning of vegetative material is appropriate only where permitted by local ordinance. Minimize adverse health effects from smoke by burning outdoors in well-ventilated areas. **Materials or products containing toxic or harmful substances, including empty pesticide bags, must not be burned.** Contact your local fire district, Cooperative Extension System, Soil Conservation District, public health district, or Division of Environmental Quality (DEQ) for more information. Batteries, motor oil, grease, lubricants, antifreeze, gasoline, and petroleum products are included in this category of potential threats to ground water.

The design and location of the vehicle and equipment maintenance area is important. Even small drips and spills can add up to a problem for ground water. Try to avoid maintenance activities close to your well (within 200 to 400 feet) and use a location where spills and drips can be contained. A common practice is to soak up small drips and spills with kitty litter. It can then be disposed of in an approved landfill.

Empty containers from oil and other vehicle maintenance products should be recycled after the product is used, if possible. Take the container to a recycling center or reuse it for product storage. If the container cannot be recycled, dispose of it at a hazardous waste collection event/ site or call your local landfill for instruction. Contact your county public works department, public health district, or DEQ regional office for further information.

Special management is needed for many of the hazardous wastes generated from your farm, household, and shop due to the potential threat to your drinking water supply. Most of these hazardous wastes can be broken down into three broad catagories:

- Automotive and equipment maintenence products
- Building and wood maintenence products
- Farm and household pesticides

3. Automotive and equipment maintenance products

Vehicle batteries

Vehicle batteries contain lead and sulfuric acid. Lead can contaminate soil and water, and acid can burn skin. A battery contains approximately 18 pounds of toxic metals and a gallon of corrosive acids.

Disposal of old vehicle batteries on-property or in a landfill is not permitted in Idaho. The only recommended way to dispose of them is by recycling. The lead in the battery can be recycled for use in new batteries and other products. The plastic battery casing is also recyclable. Batteries should be stored in a safe, dry place out of direct sunlight, out of reach of children and pets, and away from your well.

Places that sell batteries are required to take back used batteries. Some service stations and scrap metal dealers will take used batteries as well. Many communities have recycling centers which handle old automotive batteries. Contact your county public works department, health district, or DEQ regional office for information on where to recycle batteries in your area.

Oil, grease, and lubricants

Disposing of used oil around your homestead, such as on driveways or around buildings and fences, can lead to contamination of your family's drinking water supply. Used motor oil contains organic chemicals and metals. A small amount of oil can contaminate large quantities of ground water.

Always store and work with oil, grease, and other lubricants away from your well. Use up grease and other lubricating products, or share them with someone who needs them. Store waste oil in closed, labeled containers (plastic milk jugs work well) until you can take the oil to be recycled. Service stations often accept limited amounts of used oil, or can inform you of places that do. Waste oil can also be burned in an onsite space heater designed for burning oil as a fuel. Oil must be uncontaminated to be burned or recycled. **Do not mix solvents or fuel with oil as it creates a more hazardous product, unsuitable to recycle or reuse.**

Antifreeze

Pouring antifreeze on the ground or into a ditch can lead to possible ingestion by pets, seepage into the water supply, or contamination of surface water sources. Store in a safe place, secured from children and pets. Antifreeze contains chemicals which are poisonous to animals and humans. Pets will lap up an antifreeze puddle because it tastes sweet. This is often fatal.

Waste antifreeze should be reused by adding it to another cooling system. Antifreeze should not be placed into an onsite septic system, because it may kill organisms the system depends on to break down wastes and can cause the system to fail. Spilled antifreeze should be cleaned up using an absorbent material such as kitty litter, and taken to a hazardous waste collection site or event, or an approved landfill.

Gasoline and other fuels

Petroleum products are among the most hazardous substances found around the farm and home. Store these products downslope and at least 400 feet from your well, if at all possible. Use up old fuels by diluting one part old fuel with five parts new fuel to protect your engine. If disposal of old fuel is necessary, it may be taken to a hazardous waste collection event. Contact your county public works department, local public health district, or DEQ regional office for the proper procedures involving large quantities of fuel.

For more detailed information about petroleum product storage and the risks it presents, see Fact/Worksheet 4, *Petroleum Product Storage.*

Solvents

Do not dispose of solvents on your property. Disposing of solvents by dumping them on the ground or in a septic system can allow the solvents to leach to the ground water that supplies your drinking water. Always use solvents away from your well and in a ventilated area. Store them in their original containers and out of the reach of children.

Some solvents, such as paint thinner, can be cleaned and reused. Clean dirty solvents by placing them in a closed transparent container and storing them until the paint or other material settles to the bottom. Pour the clean, reusable solvent off the top. Take the sludge to an approved hazardous waste collection event or site. Large quantities of solvents can be picked up by a solvent recycler. Contact the DEQ regional office nearest you for a list of recyclers in your area.

4. Farm and household pesticides

This category of potentially hazardous substances includes all types of pesticides and pesticide containers, including those used for indoor plants, home maintenance, and yard care. Handle all categories of pesticides as directed on the label to prevent health and environmental problems. Pay particular attention to pesticides classified as "restricted use."

Federal and State laws require pesticides be used according to the specific product label directions. If you can't use the pesticide, see if a neighbor or local business may have a need for it. In some instances, mini-bulk tanks and returnable containers allow the return of excess chemicals to the place of purchase.

For leftover pesticides that cannot be used or disposed of in any of these ways, store them safely until they can be taken to an approved community hazardous waste collection site or event. In Idaho, some household hazardous waste collection programs will not take business or farm quantities of pesticides (usually no more than a few quarts). Contact the Idaho Department of Agriculture (IDA) at (208) 334-3550 for assistance in this situation; the IDA has an active statewide pesticide waste disposal program. For information about local collection events, contact your local public health district or county Cooperative Extension System office.

Always be sure stored pesticides are in original containers, properly labeled, and in a locked cabinet or building out of the reach of children. To offer the greatest protection to your drinking water, store pesticides as far away as possible from your well or well lot. **Do not store pesticides in your pumphouse.**

Pesticides come in mini-bulk tanks, plastic containers, or paper containers. Mini-bulk tanks are returned to the place of purchase when application has been completed. Some plastic containers can be returned to the place of purchase for disposal. Paper containers should be bundled and taken to an approved landfill. **Do not burn or reuse old pesticide containers.** Check with your local dealer or IDA's Division of Agricultural Technology, (208) 334-3550, to learn what container disposal opportunities are available before purchasing the pesticide.

Always triple rinse containers, return the rinse water to the spray tank and apply following labeled instructions. If you cannot return plastic containers to the place of purchase, store the triple-rinsed containers in a dry, locked storage area until you can take them to a container recycling event or to an approved landfill. **Triple-rinsed pesticide containers may still contain**

enough pesticide residue that they should not be used for any other purpose.

For more detailed information about the management and storage of pesticides on the farm, see Fact/Worksheet 2, *Pesticide Storage and Handling*. Further information on pesticide storage, handling, disposal, and safety can be obtained from the IDA's Division of Agricultural Technology, (208) 332-8500.

5. Building and wood maintenance products

The best method for managing paints, thinners, and cleaners is to buy only what you need, buy the least toxic product, and see that they are used up. Store them in well-ventilated areas out of reach of children and pets.

Paints and stains

Try to use up old paint in other painting projects, or give it to someone who can use it. Store paint in a dry place where it won't freeze. Paint usually remains usable if it mixes well when stirred and hasn't been frozen and thawed repeatedly. Paint that is no longer usable should be taken to a household hazardous waste collection event. Contact your local landfill or the DEQ regional office nearest you for more information.

Strippers, thinners, and cleaners

Do not dispose of these types of materials on your property. Some thinners and cleaners can be reused. Place them in a closed container and store until the paint or other material settles to the bottom. Pour the clean reuseable solvent off the top. Take the sludge and any materials not reusable or recyclable to a hazardous waste collection site or event. Large quantities of thinners, strippers, and cleaners may be picked up by a solvent recycler. Contact the DEQ regional office nearest you for information on recyclers.

Unused products - caulks, glues, and adhesives

These products may contain hazardous materials and should be used with care and never disposed of on the property. Store products according to the lable. If a product becomes unusable, it should be taken to a hazardous waste collection site or event.

Worksheet 5

Farm and Home Waste Management: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk rankings for homestead waste disposal practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SOLID WASTE (Addressed in Section 1 and 2)					
Homestead trash disposal-including household hazardous waste & containers	Amount of waste minimized through careful purchase, recycling, or reusing, and sharing with others whenever possible. All hazardous products separated out and taken to household hazardous waste collection day. Remainder disposed of in approved landfill.	Some products recycled or reused, but little done to reduce amount of waste. Some hazardous products separated out. Disposal in approved landfill.	Little or no recycling or reusing of products. No hazardous products separated out. **Disposal in unapproved landfill or dump.**	Little or no recycling or reusing of products. No hazardous products separated out. **Disposal on property.**	____
AUTOMOTIVE EQUIPMENT AND MAINTENANCE PRODUCTS (Addressed in Section 3)					
Drips and spills	Contained on paved area with absorbent material. Absorbent materials disposed of at approved landfill.	Contained on paved area with absorbent material. **Absorbent material disposed of at an unapproved landfill or dump.**	Drips and spills uncontained. **Occasional flushing onto property.**	Drips and spills uncontained. **Frequent flushing onto property near well.**	____
Vehicle Batteries	Taken to battery recycler or hazardous waste collection event/facility or trade-in at battery store. No storage.	**Used batteries taken to approved landfill and** stored away from well.	**Used batteries taken to unapproved landfill or dump and** stored near well.	**Disposal of batteries on property or** batteries stored near well.	____
Oil, grease, and lubricants	Taken to used oil recycler or hazardous waste collection event/facility. Reused for lubrication. Burned for heat in an approved space heater.	Liquids absorbed and disposed of at approved landfill. Stored away from well.	**Disposal at unapproved landfill or dump** and storage on property.	Storage and **disposal on property** near well.	____

Boldface type: Besides representing a higher risk choice, this practice also violates Idaho law.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
AUTOMOTIVE EQUIPMENT AND MAINTENANCE PRODUCTS *(continued)*					
Containers	Empty containers taken to approved landfill if not recyclable.	**Empty containers disposed at unapproved landfill or dump.**	**Disposal of empty containers on property.**	**Disposal of empty containers near well or disposal of partially filled containers on property.**	____
Antifreeze	Product reused, recycled or taken to approved hazardous waste collection site/event.	Disposed to municipal sewage treatment system with permission or liquids absorbed and disposed of at approved landfill **or dump.**	**Disposed at unapproved landfill or dump. Liquids not absorbed.**	**Dumped on property, or in on-site sewage treatment system.**	____
Gasoline and other fuel	Leftover fuels used up, or taken to service station or hazardous waste collection site/event. No fuels disposed of on homestead.	Leftover fuels absorbed and taken to an approved landfill.	Leftover fuels stored and **disposed on property or at dump.**	**Waste fuels spilled, dumped, or poured on ground around property near well.**	____
Unused Products, i.e. rust remover, solvents, aerosol carburator cleaner	Used up or shared with someone else or taken to hazardous waste collection site or event.	Liquid evaporated in open air. Sludge or leftover product disposed at approved landfill.	**Disposal at unapproved landfill or dump.**	**Disposal on property.**	____

See sections 1-5, Fact/Worksheet 4, Petroleum Product Storage, to determine the risks presented to your drinking water from fuel storage practices.

Boldface type: Besides representing a higher-risk choice, this practice also violates Idaho law.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FARM AND HOUSEHOLD PESTICIDES (Addressed in *section 4* of Fact/Worksheet 2.)					
Unused or banned pesticides	Unused pesticides returned to place of purchase or taken to a state or federal pesticide collection event.	Pesticides used up according to label or disposed at approved landfill, if not a hazardous waste.	**Disposal of pesticides at unapproved landfill or dump.**	**Disposal of pesticides on property.**	____
Containers	Container disposed of through recycling program or returned to dealer.	Empty containers disposed of at approved landfill. Containers triple rinsed if they contain an acute hazardous waste.	**Empty containers disposed of on property.**	**Disposal of partially filled containers on property.**	____
See section 5, Fact/Worksheet 2, ***Pesticide Storage and Handling,*** to determine the risks presented to your drinking water from pesticide handling practices.					
BUILDING AND WOOD MAINTENANCE PRODUCTS (Addressed in Section 5)					
Paints and stains	Used up or shared with someone else or taken to a collection site/event.	Liquids absorbed with kitty litter and taken to an approved landfill.	**Disposal of oil-based paints or stains at landfill or dump. Latex paint disposal on property away from well.**	**Disposal of oil-based paints or stain on property. Latex paint disposal near well.**	____
Strippers, thinners, and cleaners	Spills contained. Unused products used up, recycled or taken to hazardous waste collection site/ event.	Liquids absorbed with kitty litter and taken to an approved landfill.	**Disposal of sludge, stripper, cleaner, or thinner at unapproved landfill/dump.**	**Disposal on property.**	____
Unused products: caulks, glues, and adhesives	Used up or shared with someone else or taken to hazardous waste collection site/event.	Liquid absorbed with kitty litter and taken to an approved landfill.	**Disposal at unapproved landfill or dump.**	**Disposal on property.**	____

Boldface type, Besides representing a higher-risk choice, this practice also violates Idaho law.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Farm and Home Waste Management Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Homestead trash disposal				
Automotive equipment area drips and spills				
Vehicle batteries				
Oil, grease, and lubricants				
Containers				
Antifreeze				
Gasoline and other fuel				
Unused products				
Unused or banned pesticides				
Pesticide containers				
Paints and stains				
Strippers, thinners, and cleaners				
Unused products (caulks, glues, and adhesives)				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many cicumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action . The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classed as low risk. Activities classed as low risk generaly reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References
Who to call about...

Health concerns

• Your local public health district:

Boise:	(208) 375-5211	Caldwell:	(208) 455-5300
Coeur d'Alene	(208) 664-8736	Idaho Falls:	(208) 522-0310
Lewiston:	(208) 799-3100	Pocatello:	(208) 233-9080
Twin Falls:	(208) 734-5900	Black Foot:	(208) 785-2160
Gooding:	(208) 934-4477	Sandpoint:	(208) 263-5159

A specific product

• Contact the company that makes the product. The company's phone number is frequently on the label. Or, call the Chemical Referral Center, at (800) 262-8200. Sponsored by the Chemical Manufacturers' Association, this number will refer you to a product's manufacturer for answers about product questions.

Identification and disposal of hazardous wastes

• Contact the Idaho Division of Enviromental Quality regional office for your area:

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

Waste reduction and recycling

• Contact your local public health district, or DEQ central or local regional office.

Household hazardous waste collection events

• Contact your local public health district, public works department, DEQ regional office, or county Cooperative Extension System office about locations and dates of collection events in your area.

Pesticide waste disposal program collection events

• Contact the Idaho Department of Agriculture, Division of Agricultural Technology (208) 332-8500 for information on collection dates, locations, and sign-up requirements for your area.

Pesticides and other agricultural chemicals

• Contact the Idaho Department of Agriculture Pesticide Management Division, (208) 332-8500 for general information on pesticides.

NOTES

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Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

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Assessing and reducing the risk of ground-water contamination from

Household Wastewater Treatment

Keeping Idaho's Water Clean

Fact/Worksheet 6

Why should I be concerned?

Most rural houses have a septic system. Generally they are economical and safe, but some household wastewater can cause drinking water problems for people and animals.

Contaminants in household wastewater include disease-causing bacteria, infectious viruses, household chemicals, and excess nutrients such as nitrate. Viruses can infect the liver and cause hepatitis. Some organisms can also infect the lining of the intestine, causing gastroenteritis (vomiting and diarrhea). Coliform bacteria found in your well water indicates that the water is potentially dangerous for drinking and food preparation. Your wastewater treatment system, animal facilities, or poor well construction may be potential problem sources.

The **quantity** of wastewater can also present an environmental concern. Too much water entering the home treatment system reduces the efficiency of the system and can cause the septic system to fail.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures and dispose of wastewater as far away from your water supply well as possible. Even with large separation distances, proper disposal practices are essential to avoid risking contamination that could affect the water supplies and health of others.

What can I do?

- Make sure your septic system is large enough to meet your needs. Look for ways to reduce the amount of wastewater that enters the septic system.
- Protect your health and the quality of your drinking water by disposing of contaminants properly.
- Keep your septic system in good repair. Pump the septic tank out regularly.
- Use the worksheet to see if household wastewater is treated safely on your homestead.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your household wastewater treatment practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your household wastewater treatment practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on page 10. It should take you about 15 to 30 minutes to complete this worksheet and summarize your risk rankings.

Glossary

Household Wastewater Treatment

These terms may help you make more accurate assessments when completing Fact/Worksheet 6. They may also help clarify some of the terms used.

Aerobic treatment device: An aerated tank which produces an effluent similar to that of an intermittent sand filter.

Cesspool: Covered excavation in the ground that receives sewage directly from a building's sewer system. It is designed to retain organic matter and solids and permit liquid to seep into soil cavities. **Cesspools are prohibited in Idaho** and are a high risk for ground-water contamination (See seepage pit).

Clear water infiltration: Entry of water that does not need treatment — such as rainfall or tile drainage through direct plumbing, unsealed joints, access ports, and cracks — into a wastewater treatment system. Clear water infiltration can overload your septic system resulting in system failure.

Design capacity: Maximum volume of liquid a particular wastewater treatment system is designed to handle. For systems that include subsurface sewage disposal, capacity is affected by system maintenance and the soil's ability to accept and treat sewage effluent. If you don't know the design capacity of your system, use 200 gallons per day for a two bedroom home, add 50 gallons per day for each bedroom over two, as a minimum estimate when you fill out the worksheet. Check with your local public health district, because it may use a higher estimate.

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

Holding tank: An approved watertight receptacle for the collection and holding of wastewater.

Scum: Floatable solids, such as grease and fat.

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.

Septage: Settled, partially decomposed solids resulting from wastewater treatment in a septic tank.

Septic tank: A watertight, pre-treatment receptacle receiving sewage, designed and constructed to permit separation of settleable and floating solids from the liquid, and detention and anaerobic digestion of the organic matter, prior to discharge of the liquid.

Soil absorption: Use of soil contact in treating effluent to minimize its contamination potential. Can be done through use of a conventional drain field (trenches or beds), or alternative treatment systems (mounds or sand filters).

Improving Household Wastewater Treatment

Keeping Idaho's Water Clean

Satisfactory treatment and disposal of residential wastewater can be accomplished by on-site systems. For these systems to function over a long period of time, they need to be properly designed, installed, and maintained. When all site-specific criteria have been met, there will be minimal impact by the system on surface or ground water.

There are many types of wastewater treatment systems. A licensed Environmental Health Specialist (EHS) must evaluate the site to determine the system that is best suited to your site and needs.

In Idaho, minimum standards for on-site household wastewater systems are set by the Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ). These standards are detailed in the Idaho Administrative Procedures Act (IDAHO) 16.01.03. The codes are a minimum, so consider whether the minimum requirement is sufficient for your site.

The conventional septic system is the most common form of on-site wastewater treatment and, where soil conditions are suitable, it is the most desirable on-site system to use. Since the septic tank and drain field are completely covered with soil, the system is not visible and odor is nonexistent as long as wastewater does not surface.

1. Quantity and collection of wastewater

Strategy: Minimize the volume of household wastewater. Collect all wastewater that needs treatment, but exclude from the system all water that doesn't need treatment.

Reducing the volume of wastewater entering the treatment system is important because less flow (volume) means better treatment, longer system life, and less chance of overflow. Excess flow is a principal reason for system failure (wastewater surfacing or backing up in house). All wastewater needing treatment should be collected, however, to avoid contamination of surface or ground water.

Water use

The quantity of wastewater is dependent upon the number of people using the dwelling, how water is used, and maintenance of the water distribution system. Average water use in rural households is 40 to 50 gallons per person per day. With low-use fixtures and individual awareness and concern, a reduction to fewer than 25 gallons per person per day is possible. However, even conservative use by several people may exceed the capacity of a wastewater treatment system.

Less flow entering the system improves treatment by increasing the time waste spends in the septic tank, thus providing more time for solids' separation, settling, and decomposition. Less flow also means improved aeration and increased soil contact, providing better treatment in a soil absorption field.

Consider the following ways to minimize water use:

- Eliminate wasteful uses, such as flushing toilets to dispose of tissues or other wastes that should be handled as solid waste. Turn off water between uses and fix plumbing fixture leaks.

- Consider which actions use the most water. Toilet flushing usually ranks highest (40% of house hold use). Low-flow models could decrease water use by more than half. Composting toilets allow even greater reductions, but they can present other waste disposal challenges (See "alternative treatment systems" section).

- Bathing (30%) and clothes washing (15%) are usually next in order of water use. For bathing, consider such reduction options as using low-flow or controlled-flow showerheads which give good cleansing with less water, taking shorter showers, or turning the water off while soaping up.

- For clothes washing, use a suds saver, and run full loads. Front-loading washers use much less water, although finding one to buy may present a challenge. When running small loads, be sure to use the reduced water level setting. Wash clothes throughout the week rather than on one day.

- Modern efficient plumbing fixtures, including 1.5 to 2.5 gallon toilets, 1.5 to 2.0 gallons per minute (gpm) showerheads, faucets of 1.5 gpm or less, and front-loading washing machines of 20 to 30 gallons per 10 to 12 pound dry load, offer the potential of substantial reduction in residential water use. These reductions have commonly amounted to between 30 and 70 percent of total in-house water use (*Table 1*).

- **Your awareness of your family's water use, and how each of you can reduce it, is as important as using water conservation devices.**

Conventional fixture	Gallons used	Water-saving fixture/device	Gallons used
Toilet	4-6/flush	Low-volume toilet	1.6/flush
Shower head	4-6/min.	Low-flow shower head	2.5/min.
Faucets: Bathroom and kitchen	4-6/min.	Faucet-flow-control aerators: Bathroom and Kitchen	2.5/min.

Table 1: Water use by conventional and water-saving fixtures and devices.

Collection of wastewater

Leaky piping or septic tanks ("leakage losses") can allow wastewater to enter the ground-water supply without adequate treatment and can cause contamination. Don't allow water that doesn't need treatment (foundation drains, infiltration of rain water, roof drainage) to add to your waste volume. This is prohibited by Section 16.01.03.004.03 of the Rules for Individual and Subsurface Sewage Disposal System. Divert clear water, which doesn't require treatment, away from the house, well, and wastewater treatment system. For example, divert roof drains and surface runoff away from the soil absorption field.

In hard water areas, the water softener may be a significant user of water. Proper adjustment and timing of the softener's regeneration mechanism and using softened water for only essential uses can reduce excessive water use.

2. Quality of wastewater

Strategy: Minimize the amount of contaminants in wastewater.

The quality of water refers to what is in the water, not to the water itself. Even wastewater is more than 99 percent water. Wastewater usually contains relatively small amounts of contaminants, but they make a substantial difference in the usefulness of the water.

Contaminants found in wastewater include:

- **Bacteria and viruses**. Some can cause disease in humans. These microorganisms are usually removed by settling or through filtration in the soil. Many will die from aging or the adverse conditions in the soil absorption system.

- **Suspended solids**. These are composed of particles which are more dense (sludge) or less dense (scum) than water. Most can be separated from liquid waste by allowing enough time in a relatively calm septic tank. Grease and fats are also considered suspended solids. Soil absorption fields can be quickly clogged by wastewater high in suspended solids.

- **Organic chemicals**. These include cleaning solvents, pesticides, and fuels which usually are not degraded or removed through treatment and can pass along with the wastewater into the water supply.

- **Inorganic chemicals**. These agents may seriously compromise your on-site treatment system. Household on-site systems are generally designed to degrade only biological contaminants. Inorganic chemicals introduced into your on-site system may even harm the microorganisms which break down household wastes.

- **Nutrients**. Nitrogen from human wastes and phosphorus from detergents and some chemical water conditioners are the most notable nutrient sources. Nitrate-nitrogen is a common ground-water contaminant. In addition, phosphorus can contaminate surface water.

Oxygen demand is used as an indicator of wastewater strength. The microorganisms that decompose organic contaminants in wastewater use oxygen. The amount of oxygen required to break down wastewater is measured as biochemical and chemical oxygen demand, commonly known as BOD and COD, respectively. Organic wastes or contaminants such as blood, milk residues, and garbage grindings have high oxygen demand. Aerobic processes (in the presence of oxygen) produce stable, low-odor effluent when given enough time. Wastewater with excess oxygen demand can cause problems for soil absorption fields, ground water, streams, and lakes by reducing levels of oxygen.

Improving wastewater quality

Consider the following ways to improve wastewater quality:

- Do not use a garbage disposal unit unless the system was designed and sized for one. Garbage disposals contribute a large load of suspended solids and organic matter with their higher oxygen demand to wastewater and use additional water.
- Do not put items that may clog your disposal system, such as fats, grease, coffee grounds, paper towels, sanitary napkins, tampons, or disposable diapers, down the drain. Dispose of these as solid waste.
- Toxic substances, such as solvents, degreasers, acids, oils, paints, disinfectants, and pesticides, should not be put down drains since they may end up in ground water. This does not include bleach used to disinfect laundry or to wash clothing worn for pesticide applications.
- Do not use additives to clean or "sweeten" a septic system. They may interfere with the biological action in the tank, cause the drainfield to be clogged by sludge and scum to be carried into the field, or add toxic chemicals to ground water. Introducing additives may be prohibited by your local public health district; check with them for further information.

3. Treatment and disposal of wastewater

Strategy: Make wastewater more suitable for further treatment, disperse wastes, take advantage of the additional treatment afforded by contact with soils, and minimize the opportunity for wastewater to contaminate water supplies.

In areas where a municipal sewage system is not available and suitable soils are present, an on-site system for treatment and disposal of household wastewater is needed. The systems available for use in Idaho include septic tank-soil absorption systems, and other alternative treatment systems. Direct discharge of household wastewater to the soil surface or surface water is prohibited by regulations.

A sketch of the existing wastewater disposal system should always be retained by the owner. Any underground components should be shown on the sketch with reference points and distances to at least two permanent objects at cross angles to each other. This allows location of buried components with minimal problems.

Septic tank-soil absorption system — the most common system

In the septic tank-soil absorption system, wastewater flows from the household sewer into an underground septic tank and is then introduced to the soil through a piped distribution system (*Figure 1*). In the septic tank the waste components separate — the heavier solids (sludge) settling to the bottom, and the grease and fatty solids (scum) floating to the top. Up to 50 percent of the solids retained in the tank are decomposed by bacteria in the anaerobic digestion process. The partially treated water moves on to additional treatment and disposal in the soil absorption system.

Septic tanks and other chambers must be designed and constructed to be water tight. Among the most important components of a septic tank are the baffles. Baffles are placed in the tank to provide maximum retention of solids, prevent inlet and outlet plugging, and prevent short circuiting of wastewater through the tank.

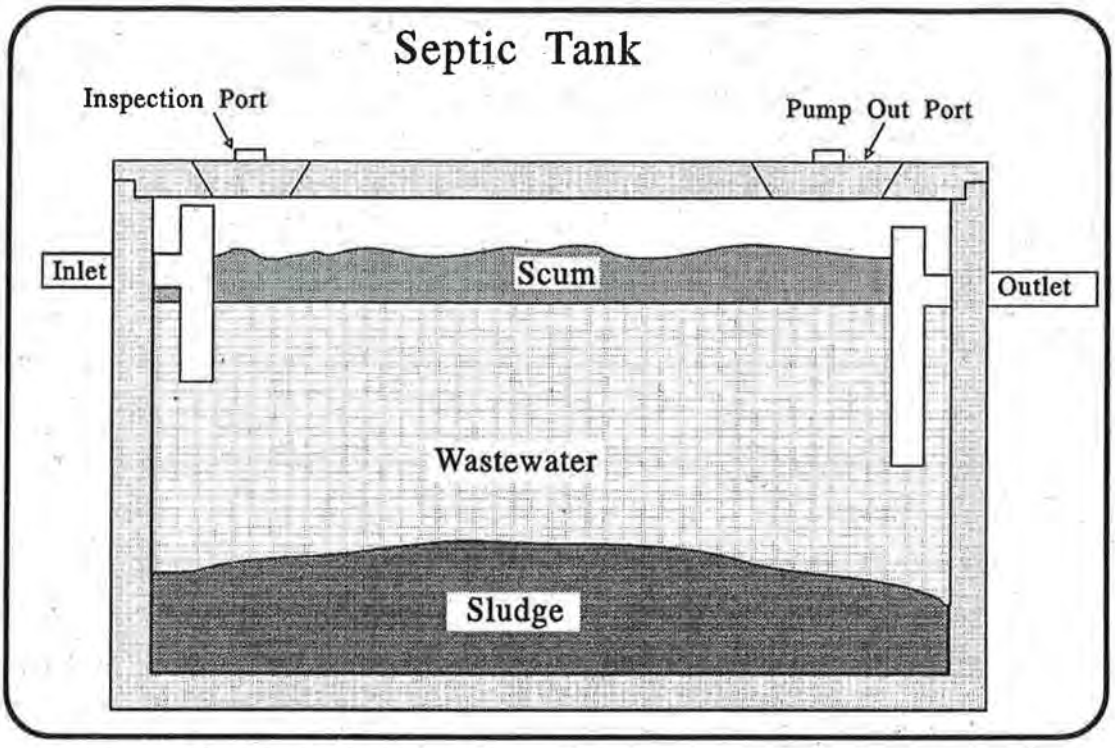


Figure 1: **Septic tank-soil absorption system.**

Septic tanks remove solids by holding wastewater in the tank. This allows the solids to settle and the scum to rise to the top. Septic tank size is based on the number of bedrooms present in the house. For a one or two bedroom house, the minimum septic tank size is 900 gallons. A three or four bedroom house is required to have a 1,000 gallon septic tank. Properly selected tanks have enough space for sludge to accumulate for an average of three years without needing solids removal.

Subsurface treatment and disposal using soil absorption — such as trenches and beds — is the common practice for household wastewater after treatment in a septic tank. The liquid portion (effluent) flows through the septic tank outlet to the soil absorption field, which is usually a series of trenches (laterals), each containing a distribution pipe embedded in drainfield gravel or rock. The effluent flows out through holes in the pipe, then down through the drainfield gravel or rock and into the soil. The soil filters out remaining solids and pathogens (disease-producing microorganisms), and dissolved substances degrade, as the wastewater slowly percolates through the soil to ground water.

Absorption fields must be maintained properly to operate at peak efficiency and minimize potential health hazards:

- Do not drive over an absorption field. Compaction from vehicles or equipment will cause settling, shifting, or breakage of lateral lines. This can lead to the surfacing of wastewater, and the creation of a health hazard.
- Never plant a vegetable garden over an absorption field. Microbes from the effluent may travel through the soil and contaminate the crop, especially root crops.
- Do not allow trees to grow over the system. Roots from the trees can cause damage to lines, as well as plug them.
- Keep a grass cover over the absorption field. This will help use some of the nutrients available and aid in evapotranspiration.

Soil absorption systems are not suitable on some sites because of slow soil permeability, shallow depth to restrictive soil layer or bedrock, shallow water table depth, or other factors. Deep, well-drained, well-developed, medium-textured soils (such as silt loam and loam) are more desirable for soil absorption systems. Coarse, sandy soils allow effluent to flow too quickly downward to ground water and do not provide adequate time for solids and pathogens to filter from the liquid.

Between three and six feet of suitable, aerated soil beneath the bottom of a soil absorption system is needed to renovate wastewater before it reaches a limiting layer. A limiting layer may be bedrock, impervious soil (claypan, hardpan, or fragipan), or extremely permeable material. Unsaturated soils allow movement of air, which helps keep the soil profile aerobic.

Disposal sites that are more distant and downslope from your well increase the isolation of your water supply from contaminated wastewater. An individual soil absorption system is required to be at least one hundred feet from any water supply, twenty feet from the foundation of the house, and five feet from property lines. However, separation distances of greater than 200 feet to water supplies are highly recommended because they provide greater protection to your drinking water supply.

Septic tank maintenance

Pumping the tank before it is 40 percent filled with scum and sludge improves functioning of the system. When the tank is filled beyond this point, sewage has less time to settle and solids can pass through to the absorption field causing premature failure. The tank is pumped through the access manhole. Consider installation of an outlet screen or filter, with service access to ground surface.

When the tank is pumped, have the baffles checked, check for tank leaks, and make any needed repairs. All other components of the septic system should be checked at this time. Keep a record book on the system and record all maintenance procedures in it. Septic system maintenance is required to be performed by a licensed professional.

The frequency of pumping depends on the capacity of the septic tank, the flow of wastewater (related to number of people in the household and water-use habits), and the volume of solids in the wastewater (more solids if garbage disposal is used).

The importance of safety around septic tanks should not be overlooked. The space within a septic tank contains gases which are toxic when inhaled. Because of this, never go into or lean into a septic tank. Fatalities have occurred from unsafe acts during septic tank maintenance and repair.

Alternative treatment systems

The Idaho Department of Health and Welfare defines alternative treatment systems as any system other than a conventional septic tank and drainfield. Although use of alternative treatment systems is encouraged, design and maintenance of such systems should be consistent with the State Technical Guidance Manual for Individual and Subsurface Sewage Disposal. Systems approved for use in Idaho are briefly described below.

Capping fill trench is a standard drainfield trench constructed so that its bottom is at least three (3) inches into the natural soil but less than two feet deep in the natural soil. A selected fill material caps the trench to provide cover.

Gravelless trench system is a standard trench design except that the drain rock is replaced by either a large diameter, nylon fabric-wrapped plastic pipe or a plastic domed chamber. Gravelless domed chamber systems are awarded a 40 percent reduction in size if arranged in trenches.

Evapotranspiration systems are a sand and gravel bed contained within an impervious lining which receives septic tank effluent and in which evapotranspiration through the surface of the sand and or plant life is the sole means of effluent removal.

Sand filters are enhanced wastewater treatment systems that are characterized by a large container with means for distributing septic system effluent atop a layer, or layers, of medium sand. As the wastewater moves downward, it undergoes biochemical degradation. There are many different

designs of sand filters, but they can generally be divided into three types: in-trench sand filters, intermittent sand filters, and sand mounds.

Further information on guidelines for these and other wastewater treatment systems is available from your local public health district or IDHW-DEQ.

4. Septage disposal

Regular pumping of septic tanks is essential to ensure proper functioning of a septic system (*see section on septic tank maintenance*). Wastes pumped from the septic tank are known as septage. Septage should be removed and disposed of only by septage haulers licensed by your local public health district. Homeowners are responsible for the proper disposal of septage, and local ordinances should be followed in all instances. Contact your local public health district for further information and a list of licensed septage haulers.

5. Assistance with failing systems or new designs

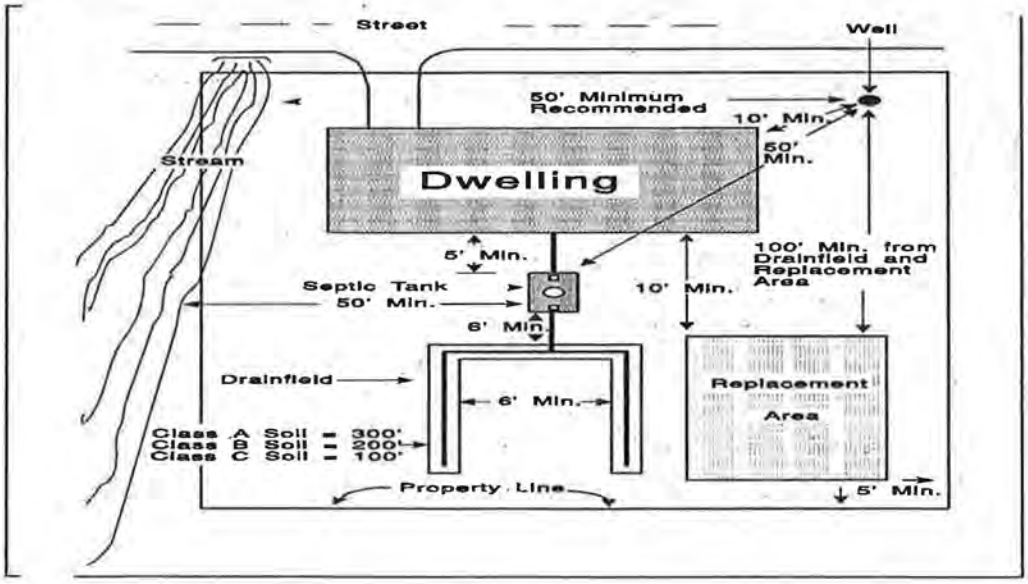
If your household wastewater treatment system is backing up or your distribution system is clogged, contact your plumber or treatment system installer. If your septic system is discharging to the soil surface or otherwise failing, contact your local public health district for permits to repair or replace your wastewater treatment system.

If you have a septic tank-soil absorption system, do not wait for the system to fail before pumping the septic tank. Once a system fails, it is too late to pump the tank and salvage the absorption field. Also avoid using septic tank additives, they can contaminate ground water. If wastewater is surfacing near or above your soil absorption field, don't cover it with more soil. This costs money and does not fix the system. The wastewater will soon surface again.

If your wastewater treatment system is leaking or showing signs of failure, seek help to correct the problem. **Do not pipe the sewage to the road ditch, storm sewer, stream, canal, or farm drain tile -- this pollutes the water, creates a health hazard, and is illegal.** Also, do not run the sewage into a sinkhole or drainage well because it can potentially pollute ground water.

A properly designed, constructed, and maintained system can effectively treat wastewater for many years. For more information on septic systems and wastewater lagoons, or for advice on alternative wastewater systems, contact your local public health district.

6. Dimensional requirements for a standard drainfield



Worksheet 6

Household Wastewater Treatment: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk of drinking water contamination.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
QUANTITY (Addressed in *Fact/Worksheet Sheet 6, Section 1*)					
Water use	Conservative water use (less than 30 gallons per person per day). Good maintenance of water-conserving fixtures. No water softener. Whole house use is much less than design capacity.*	Moderate water use (30–75 gallons per person per day). Fair maintenance of fixtures. Some water conservation fixtures. Water softener recharges twice a week or less. Whole house use is less than design capacity.*	High water use (75–120 gallons per person per day). Poor maintenance of fixtures. Water softener recharges more than twice a week. Whole house use may exceed design capacity.*	Excessive water use (greater than 120 gallons per person per day). Leaking fixtures. No water-conserving fixtures. Whole house use frequently exceeds design capacity.*	____
Collection of wastewater	Separate stormwater collection and drainage away from septic system. No settling of soil near tank or collection system. Effluent pipe more than 100 feet from well.	No leakage loss of water from collection system needing treatment. Water draining onto drainfield site. Effluent pipe more than 100 feet from well.	Some leakage of water that should be treated. Stormwater ponds over septic tank. Effluent pipe more than 50 feet from well.	Leakage loss of water that should be treated (Example-discharge of washing machine water on ground). Settling near tank or collection system. **Direct connection from gutters or footing drains to septic system.****	____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice violates Idaho law.

*If design capacity of your treatment system is unknown, estimate at 200 gallons per day for a two bedroom home.
**It is illegal for subsurface sewage disposal system to be connected directly to gutters or footing drains.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
QUALITY (Addressed in *Fact/Worksheet Sheet 6, Section 2*)					
Settleable solids	No use of garbage disposal unit in kitchen sink. No disposal of bulky items (disposable diapers, sanitary napkins) in toilet.	Minimal use of garbage disposal unit (less than 3 times per week) and no disposal of bulky items in system.	Moderate use of garbage disposal unit (3–7 times per week) and little disposal of bulky items in system.	Frequent use of garbage disposal unit (more than once per day) or disposal of bulky items in system.	____
Dissolved solids (household chemicals)	Minimal disposal of diluted household chemicals (few cups per week), such as acids, degreasers, or disinfectants. No water softener, or not recharged on site.	Careful disposal of diluted household chemicals (few pints per week). Water softener used, recharged on site.	Moderate disposal of diluted household chemicals (few quarts per week).	Extensive disposal of diluted household chemicals (gallons per week). **Any disposal of concentrated/undiluted household chemicals.**	____
Floatable solids	No disposal of cooking grease or oils into septic system. Oil and grease wiped from cooking utensils before washing.	Occasional disposal of grease or oils. Some attempt made to reduce disposal of grease and oil from household, with little generated.	Routine disposal of grease or oils. No attempt to reduce disposal of grease and oil from household, but little generated.	Extensive disposal of cooking grease or oils in household septic system.	____
SITE CHARACTERISTICS (Addressed in *Fact/Worksheet Sheet 6, Section 3*)					
Horizontal separation of wastewater treatment and disposal site from water supply	Treatment and disposal in municipal treatment facility. On-site treatment and disposal more than 400 feet downslope from well.	Treatment and disposal 200–400 feet downslope from well.	Treatment and disposal 100–200 feet downslope from well.	Treatment and disposal upslope, **or less than 100 feet from well on any slope.***	____
Vertical separation between soil absorption system and bedrock, extremely permeable material or normal high ground water	Greater than 6 feet.	4-6 feet, using pressure distribution system.	2.5-4 feet	**Less than 2.5 feet.**	____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice violates Idaho law.
*State rules require at least 100 feet of horizontal separation distance.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SITE CHARACTERISTICS (continued)					
Soil type	Porous silt loams, sandy clay loams, or silty clay loams.	Loams - silt loams.	Medium sands to fine sands - loamy sands.	Very gravely, coarse sands; very gravelly, loamy sands. **Coarse sand.***	____
TREATMENT AND DISPOSAL (Addressed in *Fact/Worksheet Sheet 6, Section 3*) Select the wastewater treatment and disposal components that apply to your site.					
Septic tank (A disposal component, such as soil absorption, should also be used as part of your system)	Multiple compartment tank or tanks in series. No leakage. Checked every 1–2 years and pumped as needed. Baffles in place. Good maintenance.	Single compartment tank. No leakage. Checked at least every 3–5 years and pumped as needed. Baffles in place. Good maintenance.	Single compartment tank. No known leakage. Delayed maintenance schedule or tank in poor repair.	**Leakage losses**. Tank not pumped and maintenance not performed until problems develop.	____
Soil absorption (lateral, mound, bed, seepage pit or drywell, or surface disposal) after septic tank or other treatment system	Well-maintained drain field or mound system loaded below design capacity.** Medium to fine-textured soils (silt loam, loam, clay loam) with more than 6 feet to saturated soil, bedrock, or other limitation.	Drain field or mound system on coarse-textured soils (sandy loam, sand) with more than 4 feet to saturated soil or limiting layer. Loaded below design capacity.** Well maintained.	Drain field or mound system with less than 4 feet to saturated soil or limiting layer. Loaded near design capacity.**	**Pipe to surface**. Field drainage system. Poorly maintained or failed lateral or mound system. System loaded above design capacity.** Seepage pit.	____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice violates Idaho law.

*Unsuitable soil type.

**If design capacity of your treatment system is unknown, estimate at 200 gallons per day for a two bedroom home.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
TREATMENT AND DISPOSAL (*continued*)					
Select the wastewater treatment and disposal components that apply to your site					
Cesspool	_____	_____	_____	**Any cesspool or surface discharge of wastewater.**	_____
SEPTAGE AND HOLDING TANK PUMPAGE DISPOSAL (Addressed in *Fact/Worksheet Sheet 6, Section 4*)					
Septage pumping and disposal	Licensed septage hauler. Disposal at approved treatment facility.	Licensed septage hauler. Disposal location unknown.	Licensed septage hauler. **Disposal at a non-approved site**	**Non-approved septage hauler. Disposal at non-approved site.**	_____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice violates Idaho law.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Household Wastewater Treatment Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Water use				
Collection of wastewater				
Settleable solids				
Dissolved solids				
Floatable solids				
Horizontal separation of wastewater treatment and disposal site from water supply				
Vertical separation betweeen soil absorption system and impervious layer or seasonal high water table				
Soil type				
Septic tank				
Soil absorption				
Cesspool				
Septage pumping and disposal				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action . The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Household wastewater treatment

- Your local public health district, or IDHW-DEQ, Community Programs, Onsite Wastewater Tretment, (208) 334-5860.
- Regulations are available from the Administrative Rules Coordinator, 700 W. State, Boise, ID., 83720, (208) 334-3577.

What to read about...

Publications are available from sources listed at the end of the reference section.

Ground water contamination, protection, and testing

- Idaho Groundwater Quality Plan: Protecting Ground Water Quality in Idaho, 1992. Ground/ Water Quality Council, Boise, ID., 109 pp.
- Idaho Groundwater Quality Protection, A Manual for Local Officials, 1989. IDHW-DEQ, Boise, ID., January 1989. 41 pp.
- Idaho Lake Management Guide, 1987, IDHW-DEQ, Water Quality Bureau Report. Boise, ID., 42 pp.
- Rupert, M., T. Dale, M. Maupin, and B. Wicherski. 1991, Groundwater Vulnerability Assessment Snake River Plain, Southern Idaho, IDH&W-DEW, Boise, ID. 25 pp.
- Tolman, J. and R. Fox, 1987. Idaho Guidelines for Non-public Water Systems, District Health Departments, Boise, ID. 29 pp.
- Technical Guidance Manual for Individual and Subsurface Sewage Disposal. 1993, IDHW-DEQ, Community Programs. 149 pp.
- Burnell, B., 1994, A Homeowners Guide to Septic Systems. (In Press). IDHW-DEQ, Community Programs, Boise, ID. 4 pp.

Rules

- IDAPA 16.01.03 Rules for Individual and Sub Surface Sewage Disposal.
- IDAPA 16.01.08 Rules Governing Drinking Water.
- IDAPA 16.01.15 Rules Governing the Cleaning of Septic Tanks.
- US EPA 40 CFR Part 503 Standards for the use or Disposal of Sewage Sludge. Federal Register 58 (32); 9248-9415, Friday Febryary 19, 1993.
- US EPA, 1993. Domestic Septage Regulatory Guidance: A Guide to the 503 Rule, EPA 832-B-92-005 September, 1993.

Installation and maintenance

- Installation and Maintenance of Septic Systems. 1988. North Central District Health Department. Lewiston, ID. 9 pp. brochure.

Publications available from...

- Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
- U.S. Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460. USDA, National Center for Environmental Publications and Information, Cincinnati, OH 45268.
- Dick Hetherington, USDA Water Division, mail stop WD134, 1200 6th Ave., Seattle, WA 98101. (206) 553-1941
- Sonja Ross, US EPA, WH-586, EPA Sludge Risk Assessment, 401 "M" St. S.W., Washington, D.C. 20460.

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Animal Manure Storage

Keeping Idaho's Water Clean

Fact/Worksheet 7

Why should I be concerned?

Farmers store animal manure so they can spread manure when crops need the nutrients. They save money because they don't need to purchase as much fertilizer. Accumulating manure in a concentrated area, however, can be risky to the environment and to human and animal health. Poorly designed or mismanaged manure storage systems can allow contamination of surface or ground water sources by the nutrients and disease-causing organisms contained in animal wastes.

Facilities which store manure in liquid form on the homestead may leak or burst, releasing large volumes of pollutants. Manure in earthen pits under some soil conditions form a semi-impervious seal of organic matter that does limit leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of nitrate contamination of ground water.

If nitrate concentrations in drinking water are greater than federal and state drinking water standards of 10 mg/L,* nitrate-nitrogen can pose health problems for infants younger than six months of age, including the condition known as methemoglobinemia (blue baby syndrome). Young animals are also susceptible to health problems from high nitrate-nitrogen concentrations. Concentrations of 20-40 mg/L in the water supply may prove harmful, especially in combination with high concentrations (1,000 ppm) of nitrate-nitrogen from feed sources.

Animal wastes are potential sources of approximately 150 diseases. Illnesses potentially transmited by animal manure include diseases such as typhoid fever, cholera, tuberculosis, and polio. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence suggests that other contaminants can be flowing into ground water. The detection of any coliform bacteria in a drinking water sample is considered as "bacteriologically unsafe."

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

*means milligrams per liter, equivalent to parts per million for water measure

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your animal manure storage practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your animal manure storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete this worksheet and summarize your risk rankings.

Glossary

Animal Manure Storage

These terms may help you make more accurate assessments when completing Fact/Worksheet 7. They may also help clarify some of the terms used.

Composting facility: A facility for the biological decomposition and stabilization of manure organic material.

Concrete stave storage: A type of liquid-tight animal manure storage structure. Located on a concrete pad, it consists of concrete panels bound together with cables or bolts and sealed between panels.

Earthen basin or pond: Clay-lined manure storage facility constructed according to specific engineering standards. Not simply an excavation.

Engineering standards: Design and construction standards available at Natural Resources Conservation Service (NCRS) or Cooperative Extension System (CES) offices. These standards may come from NRCS technical guides, state regulations, or land grant university engineering handbooks.

Filter strip: A gently sloping grass plot used to filter runoff from the livestock lot and some types of solid manure storage systems. Influent waste is distributed uniformly across the high end of the strip and allowed to flow down the slope. Nutrients and suspended material remaining in the runoff water are filtered through the grass, absorbed by the soil, and ultimately taken up by plants. Filter strips must be designed and sized to match the characteristics of the animal lot or storage system.

Glass-lined steel storage: A type of liquid-tight, above-ground animal waste storage structure. Located on a concrete pad, it consists of steel panels bolted together and coated inside and outside with glass to provide corrosion protection.

Manure storage pond: An impoundment made by excavation or earthfill for temporary storage of animal or other agricultural waste.

Manure treatment lagoon: An impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.

Nutrient management plan: A plan to manage the amount, form, placement, and timing of applications of plant nutrients.

Poured concrete storage (manure tank): A type of liquid-tight animal manure storage structure. Located on a concrete pad, it consists of poured concrete reinforced with steel, and may be above ground or below ground.

Water table depth: Depth to the upper surface of ground water. This depth is sometimes indicated in the county soil survey, but varies from county to county. This information may be available from your well construction report or from hydrogeological reports and ground-water flow maps of your area. Your county Cooperative Extension System agent, NRCS specialist, or a local well driller may also be able to help you gather this information.

> There are two types of water tables: (1) the water table typically noted in a well log as an indication of usable water supply; and (2) the seasonal high water table. The seasonal high water table is more important in regard to construction of animal manure storage facilities because it may present facility construction problems.

Keeping Idaho's Water Clean

Improving Animal Manure Storage

When animal manure is stored, it must be accumulated in some type of structure until it can be applied to the land. Manure storage can be either positive or negative from an environmental standpoint.

Manure storage can benefit the environment if it is stored until it can be safely spread, incorporated into the soil, and used by a growing crop. The environmental safety of collecting large amounts of manure in one place for an extended period is dependent on four factors:

1) Proper design, construction, and operation of the storage facility.
2) Proper land application of the manure once it leaves the storage facility.
3) Physical and chemical characteristics of the soil and subsurface geologic materials within the storage area, as well as the area to which any runoff might flow.
4) Potential for ground-water contamination.

Stored manure should be applied according to a schedule which is developed as part of an overall operating plan. Consider weather conditions, nutrient uptake requirement of crops, availability of help and equipment, field availability, and the accumulation of waste. The best times for land application are spring, just before planting, and fall (before snow and frozen soil conditions occur). Apply manure to fields containing the greatest amount of actively growing vegetation or crop residue, and incorporate to maximize utilization of nutrients. Winter application is not recommended. Storage facilities should be designed and maintained to eliminate the need for winter application.

Stored manure can easily be sampled and tested to determine how much nitrogen, phosphorus, and potassium it contains. When sampling manure, be sure to obtain as representative a sample as possible. This information, combined with a knowledge of the amount of manure applied per acre, determines whether additional commercial fertilizer is needed to meet realistic crop production goals.

Adequate manure storage reduces the need for land application during winter months when soil is saturated or frozen. This improves efficiency, saves wear and tear on equipment, conserves nutrients contained in the manure, prevents soil compaction, and minimizes manure nutrient leaching and runoff.

1. Long-term storage

Animal manure can be stored either in solid, semi-solid, or liquid states:

- Composting can be an alternative.
- Solid facilities stack heavily bedded manure against walls and on slabs.
- Semi-solid facilities use pumps to move manure into containment areas and may seperate solids from liquids.
- Liquid facilities hold manure in tanks or manure storage ponds.

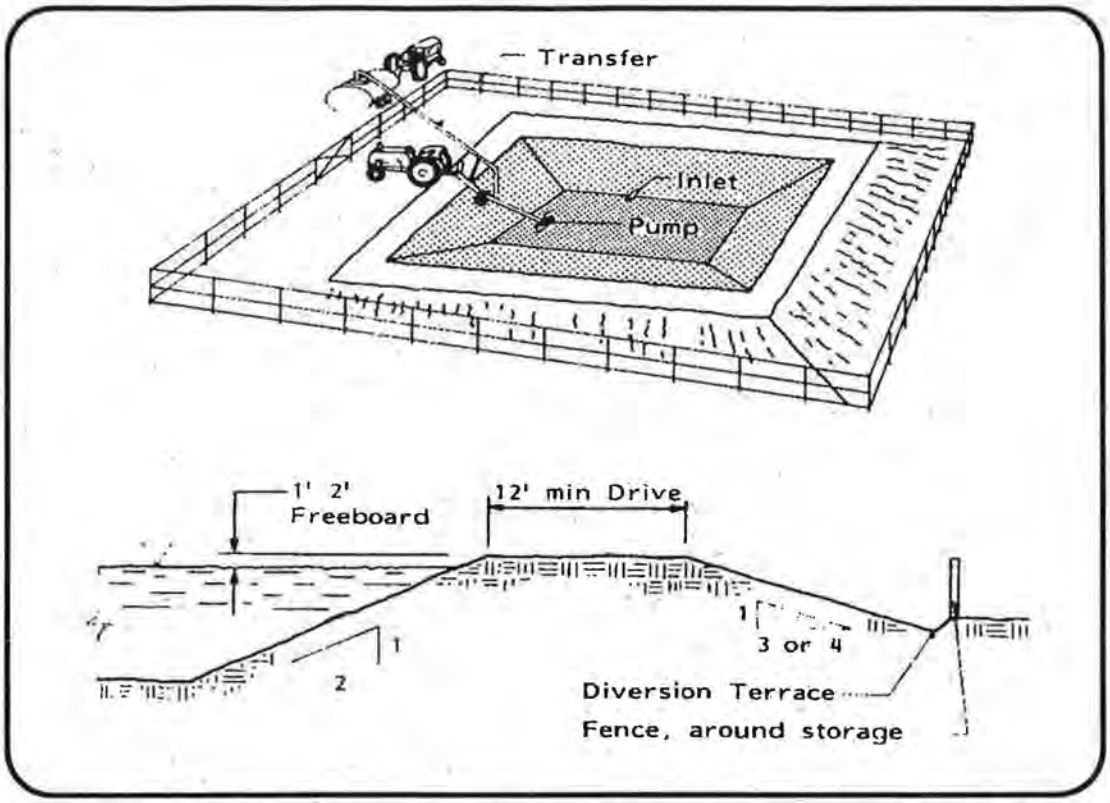


Figure 1: Earth basin for manure storage. *Source: Livestock Waste Facilities Handbook, MWPS-18, Midwest Plan Service, Ames, Iowa.*

Liquid and semisolid storage systems are self-contained (*Figure 1*). Ground-water contamination can occur if the facility is not structurally sound and properly lined, allowing contaminants to seep into the soil. A threat to surface water exists if manure storage structures are not emptied frequently enough, thereby allowing manure to flow over the top of the structure.

Liquid storage systems should have sufficient storage capacity to handle animal manure during the rainy season and extreme storm events. Storage for 180 days and a 25-year, 24-hour storm event is usually recommended for facilities in Idaho. Additional storage capacity is recommended for a one in five year storm event and normal precipitation containment.

Liquid storage systems require the use of pumps and pipes for moving wastes from the barn to the storage structure. These must be properly installed and maintained to ensure that they do not leak.

Each time they are emptied, carefully check **steel and concrete structures** for cracks or the loss of watertight seals. If any breaks are apparent, repair them immediately. Likewise, check the walls of **manure storage ponds** when emptied to be certain that liner materials are not cracked or eroded.

While seepage from in-ground manure storage facilities is not always easy to recognize, there are some telltale signs:

- A properly designed structure has the capacity to handle manure from a specific number of animals for a known number of days. If a pit designed for 180 days of storage receives designated manure amounts, but does not fill to the design level in six months, the pit may be leaking.

- Evaporation from liquid storage pits is minimal during the late fall, winter, and early spring. If additional liquids have to be added in the spring before a pond can be

agitated and pumped, it may be leaking. During warmer months, addition of liquids may frequently be needed for pumping due to evaporation losses. Monitoring wells installed around the pond upslope and downslope would be encouraged to confirm seepage.

Another method of determining leakage is through the construction and use of a stilling well. It is an eight or ten inch section of perforated PVC pipe secured in a vertical position to the bottom of the waste lagoon. The length should be about six inches taller than the depth of the lagoon when the water height is read. A hook gauge is used to very accurately measure the depth of the lagoon over a two week period. Evaporation losses are accounted for through use of an onsite evaporation pan. During the period of measurement, no liquid should enter nor leave the lagoon. Alternative holding structures are needed during the measurement period.

Some facilities for storage of solid or semisolid manure are designed to allow seepage from the stack. In these instances, structure design must include treatment for the wastes that seep out. Use of these facilities should only be for control and treatment of lot runoff wastes, not for continuous, concentrated wastes such as swine slurry or dairy wastes. If conditions allow, structures such as picket dams can be used to hold back solids, and grass filter strips can be used to help remove remaining pollutants in lot runoff water. These systems should not be considered on sites with coarse-textured soils, creviced bedrock, or shallow water tables. Care must be taken to ensure that the system is not overloaded.

Both systems require maintenance. With grass filter strips, it is important to ensure that the ammonia in highly concentrated manure does not "burn" vegetation in the filter strip. A thick, healthy stand of vegetation allows runoff to seep into the soil and uses the nutrients in the water.

The best way to handle seepage is to channel it into a watertight holding pond or storage tank. In those areas where not enough soil is available for the construction of filter strips, or where the construction of a holding pond is not feasible, another option is to build a roof over the structure to eliminate additional water being added to the manure stack. Roofed storage systems require adequate bedding to absorb and retain the liquid portion of the manure.

2. Short-term storage

Short-term storage allows producers to hold animal manure during periods of bad weather when spreading may not be feasible, when crops are growing and land is not available for applying manure, or when there is a shortage of crop acres to handle frequent hauling and spreading of manure without the threat of runoff.

Short-term storage has the disadvantage of requiring that the manure be handled twice. Designs are available, though, for **short-term storage structures** that facilitate handling and provide effective protection for surface and ground water.

Short-term storage systems may be applicable if you often find that you must **stack manure in fields,** particularly during periods of bad weather. This is not a recommended practice. No matter how it is done, it poses a contamination threat to surface and ground water. If manure is frequently stacked in fields, it might be appropriate to consider constructing a short-term storage facility.

Scraping manure into **piles in the animal lot** during bad weather or busy work periods is not recommended because of possible herd health problems and water pollution. The severity of those problems depends on characteristics of the animal lot area where the manure is piled and the area to which runoff flows.

Open housing, such as pole sheds, are often used to allow manure to accumulate for extended periods of time. Roofs on these structures keep rain and snow off the manure. These structures are relatively safe for water quality if they are protected from surface water runoff, and if adequate bedding is provided to absorb liquids in the manure. To minimize water quality impacts, **provide adequate bedding to reduce seepage and clean these sheds as frequently as possible.**

The use of long-term storage methods is preferable to short-term techniques. Long-term storage practices and structures are generally better designed to deal with unplanned occurrences, such as major storm events, and provide better overall protection of water quality.

3. Manure storage location

Urban development, zoning ordinances, proximity of residences, business, recreational areas, roads, and highways need to be considered. Recommended minimum distances from a waste storage facility are:

Domestic well: 100 feet; 200-300 feet preferable.
Public well: 1,000 feet (from Wellhead Protection Program).
Property line: 300 feet.

Expected growth of residential areas should always be considered in site selections. In some cases, zoning requirements may be more restrictive than these recommendations. Contact your local county office of planning and zoning for specific information. See listing under County Government in the phone book.

Minimum separation distances should guide new well installation or the distance from existing wells to new manure storage facility construction. Make every effort, however, to exceed the regulations and strive to meet current recommendations whenever possible.

Observing these separation distances when siting a new facility is a good way to help protect your drinking water. Locate manure storage facilities downslope from the well to protect your water supply. For more information about separation distances and how the condition of your well might affect the potential for contamination (See Fact/Worksheet 1, *Drinking Water Well Condition*).

While observing well separation minimum distances may help to protect your own well, poorly designed or poorly maintained animal manure storage facilities could still contaminate the ground water that supplies other local drinking water wells. Protecting the ground water resource as a whole can help protect your neighbors' wells, as well as the quality of drinking water supplies for future generations.

Depth to seasonal high water table or fractured bedrock and soil type at the manure storage location are other important factors. These are among the site vulnerability characteristics covered in *Worksheet A, Site Evaluation.*

It is important that earthen waste storage structures not leak or otherwise excessively discharge pollutants to surface or ground waters (potentially causing a violation of Idaho State Ground Water Quality Standards). The Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ) administers these standards and encourages the use of Natural Resources Conservation Service (NRCS) standards and specifications for the location, design, construction, and operation of these structures. The Idaho Waste Management Guidelines for Confined Animal Feeding Operations can also provide valuable information.

Depth to water table is sometimes available in the county soil survey, but this varies from county to county. Your county Cooperative Extension System agent, NRCS, Soil Conservation District personnel, or a local well driller may also be able to help you gather this information.

4. Land application of animal manure

Land application is the predominant method of using animal manure. When properly managed, land application offers safe and beneficial use of manure nutrients and water by vegetation. Both solid and liquid manure should be applied to land using rates and methods that prevent surface runoff of pollutants, as well as the potential for the leaching of pollutants to ground water.

Soil analysis and a manure application plan that balances available manure nutrients with crop needs should be completed before manure application begins. Application rates should not exceed the nitrogen or moisture needs of the plants growing or to be grown on the field site and applied nutrients should be credited in the fertilizer program for the field site. Application of animal manure to cropland at low application rates poses little danger to surface or ground water due to filtering of contaminants by the soil or plant uptake of nutrients.

5. Other management factors

If animal manure storage causes water contamination, IDHW-DEQ can issue a notice which will require corrective measures. All animal waste storage structures should be designed and constructed according to the Idaho Waste Management Guidlines for Confined Feeding Operations. Contact your county planning and zoning office for information about local ordinances, your DEQ regional office about state regulations, and your Farm Service Agency (FSA) or Soil Conservation District (SCD) office about cost-sharing funds.

6. Abandoned manure storage structures

Abandoned manure storage structures, especially earthen ones, can pose significant water quality problems. Any abandoned structure should be completely emptied. In the case of earthen manure storage facilities, liner materials (to a depth of about two feet) should be removed and spread over croplands. The remaining hole should be filled and leveled. Manure packs from structures and lots no longer in use also should be removed and the manure applied to land. If manure is stacked in fields, it should be removed as soon as conditions permit.

Worksheet 7

Animal Manure Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describe conditions on your homestead (skip and leave blank any categories that don't apply to your homestead). For categories separated by "**or**," choose only one category.
3. Then look above the description you circled to find your "rank number" (4,3,2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk rankings for homestead waste disposal practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LONG-TERM STORAGE (180 days or more) (Addressed in Section 1)					
Manure storage pond (below ground)	Designed and installed according to accepted engineering standards and specifications. Properly maintained. Water table deeper than 20 feet. Built to post-1985 standards.	Designed and installed according to accepted engineering standards and specifications. Properly maintained. Water table deeper than 20 feet. Built to pre-1985 standards.	Not designed to engineering standards. Constructed in medium or fine-textured dense materials (silt loam, loam, clay loams, silty clay). Water table deeper than 20 feet. Earthen lining eroding.	Not designed to engineering standards. Constructed in coarse-textured materials (sands, sandy loam). Fractured bedrock or water table shallower than 20 feet. More than 10 years old. Earthen lining perforated.	_____
or					**or**
Steel, glass-lined (liquid-tight design, above ground)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Leaking tank on medium-textured soils (silt loam, loam).	Leaking tank on coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	_____
or					**or**
Concrete stave (liquid-tight design)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Concrete cracked, coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	_____
or					**or**
Poured concrete (liquid-tight design)	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Concrete cracked, coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SHORT-TERM STORAGE (usually 30-90 days; in some cases, up to 180 days) (Addressed in Section 2)					
Stacked in field (on soil base)	_____	_____	Stacked on high ground. Medium or fine-textured soils (silt loam, loam, clay loams, silty clay). Water table is deeper than 20 feet.	Stacked on high ground or floodplain. Coarse-textured soils (sands, sandy loam). Fractured bedrock or water table shallower than 20 feet.	_____
Stacked in lot	Covered concrete lot with curbs, gutters, and settling basin.	Concrete lot with curbs and gutters. Grass filter strips installed and maintained.	Earthen lot with medium or fine-textured soils (silt loam, loam, clay loams, silty clay). Water table deeper than 20 feet.	Earthen lot with coarse-textured soils (sands, sandy loam). Fractured bedrock or water table shallower than 20 feet.	_____
Water-tight structure	Designed and installed according to engineering standards. All liquids retained.	Designed and installed according to engineering standards on medium and fine-textured soils (silt loam, loam, clay loams, silty clay). Water table deeper than 20 feet.	Designed and installed according to engineering standards on coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	Designed and installed according to engineering standards. Not properly maintained. Water treatment and diversion and terrace structures allowed to deteriorate.	_____
Stacked in open housing	Building has concrete floor, protected from surface water runoff. Adequate bedding provided.	Building has earthen or concrete floor on medium or fine-textured soils (silt loam, loam, clay loams, silty clay), protected from surface water runoff. Water table deeper than 20 feet.	Building has earthen or concrete floor on medium or fine-textured soils (silt loam, loam, clay loams, silty clay), subject to surface water runoff. Water table or fractured bedrock shallower than 20 feet.	Building has earthen floor on coarse-textured soils (sands, sandy loam), subject to surface water runoff. Water table or fractured bedrock shallower than 20 feet.	_____
NO STORAGE	**(Hauled off farm or spread in less than 30 days)**				
	Hauled off farm for proper storage.	Daily spreading.	_____	***Site not designed for manure storage.***	_____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice also violates Idaho law.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION (Addressed in Section 3)					
Location of animal manure storage in relation to drinking water well	Manure stack or earthen manure storage pit more than 400 feet from well. Manure storage structure (liquid tight) more than 200 feet from well.	Manure stack or earthen manure storage pit more than 250 feet from well. Manure storage structure (liquid tight) more than 100 feet from well.	Manure stack or earthen manure storage pit less than 250 feet down-slope from well. **Liquid-tight manure storage structure less than 50 feet down-slope from well.***	Manure stack or earthen manure storage pit less than 250 feet upslope from well. **Liquid-tight manure storage structure less than 50 feet upslope from well.***	____
MANURE APPLICATION SITE (Addressed in Sections 4 and 5)					
Separation distance and site conditions	Incorporated into unfrozen, unsaturated soil, or applied at site with heavy vegetation more than 200 feet from wellhead.**	Incorporated into unfrozen, unsaturated soil, or applied at site with heavy vegetation less than 200 feet from wellhead.**	Applied to unfrozen, unsaturated soil with no incorporation and little vegetation 200-500 feet from wellhead.	**Applied to frozen, saturated, or snow covered soil. Applied to site with no incorporation and little vegetation less than 50 feet from well-head.**	____
Application rate	Applied at rate of available nutrients equal to or less than plant needs based on soil test.** Annual application less than 250 pounds available nitrogen or less than 20 dry tons of solid waste per acre.	Low rates of application used with no soil tests performed.** Annual application less than 250 pounds available nitrogen or less than 20 dry tons of solid waste per acre.	High rates of application used with no soil tests performed. Rate may exceed plant needs. No farm nutrient management plan.	**Applied at rate greater than plant needs. Annual application more than 250 pounds available nitrogen or more than 20 dry tons of solid waste per acre.**	____

Boldface type in high risk column: Besides representing a higher-risk choice, this practice also violates Idaho law.

*Not allowed by most planning and zoning boards. Existing wells must meet separation requirements in effect at time of construction.

**Applied at the times and rates specified in the farm nutrient management plan.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Animal Manure Storage Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Manure storage pond (below ground)				
Steel, glass-lined (liquid-tight design)				
Concrete stave (liquid-tight design)				
Poured concrete (liquid-tight design)				
Stacked in field (on soil base)				
Stacked in lot				
Water-tight structure				
Stacked in open housing				
No storage				
Location of animal manure in relation to drinking water well				
Separation distance and site conditions				
Application rate				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Manure storage and structure design

• Contact your county Cooperative Extension System (CES), Soil Conservation District (SCD), Natural Resources Conservation Service (NRCS) office, or the DEQ regional office for your area.

Cost-sharing information

• Financial assistance for animal manure management practices, including manure storage, may be available. Contact your local CES or NRCS office.

Animal manure management

• *Agricultural Waste Management Field Handbook*, Soil Conservation Service, 1992. (3) a comprehensive guide addressing animal management and resource protection, contains design standards and accepted animal waste management practices for confined animal feeding operations. Contact the NRCS or the DEQ regional office for your area:

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

• Contact your County Planning and Zoning Commision for any local regulations pertaining to securing new permits.

What to read about...

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.

Ground-water contamination, protection and testing

• *Quality Water for Idaho: Nitrate and Groundwater* CIS 872 (1)
• *Quality Water for Idaho: Water Testing* CIS 873 (1)
• *Quality Water for Idaho: Drinking Water Standards* CIS 874 (1)
• *Quality Water for Idaho: Idaho's Water Resource* CIS 887 (1)
• *Quality Water for Idaho: Groundwater in Idaho* CIS 900 (1)
• *Dairy Waste Management System Planning-Estimating Storage* EXT 694 (1) A list of laboratories certified to conduct water sample analysis is available from your Cooperative Extension System agent or local public health district.

Handling, management, and storage of animal manure

• *Agricultural Waste Management Field Handbook.* NRCS, 1992. (3) A comprehensive guide addressing animal management and resource protection.
• *Livestock Waste Facilities Handbook.* 1985. Midwest Plan Service. (2) Includes information about land application techniques and animal waste utilization, as well as a worksheet to help determine manure application rates.
• *Idaho Waste Management Guidelines for Confined Feeding Operations* DEQ (4)

Planning and design of animal manure storage facilities

• *Agricultural Waste Management Field Handbook.* Soil Conservation Service, 1992. (3) A comprehensive guide addressing animal management and resource protection.
• *Livestock Waste Facilities Handbook.* 1985. Midwest Plan Service. (2) Focuses on planning and design of livestock waste facilities and equipment; includes information about land application techniques and animal waste utilization. Includes a worksheet to help determine manure application rates.
• *Outside Liquid Manure Storages.* 1979. Midwest Plan Service. AED-23. (2) Discusses sizing, emptying, and loading earth storage basins and non-earth above-ground storages.
• *Dairy Waste Management System Planning-Estimating Storage* EXT 694(1)
• *Earth Storage Basins for Liquid Manure* WI/A2795
• *Circular Concrete Manure Tanks.* 1983. Midwest Plan Service. TR-9. (2)
• *DEQ-Idaho Waste Management Guidelines for Confined Feeding Operations* (4)

Land application of animal manure

• *Livestock Waste Facilities Handbook.* 1985. Midwest Plan Service. (2) Includes information about animal waste characteristics, collection and transport to storage, open lot waste handling, land application techniques and waste use. Worksheet helps producers determine manure application rates for their system.
• *How to Calculate Manure Application Rates in the Pacific Northwest* PNW0239 (1)
• *DEQ-Idaho Waste Management Guidelines for Confined Feeding Operations* (4)

Publications available from...

• Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
• Your county Cooperative Extension office or the Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.
• Your local Natural Resource Conservation Service Office.
• Idaho Department of Health and Welfare-Division of Environmental Quality, 1410 N. Hilton, Boise, ID 83706

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

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Assessing and reducing the risk of ground-water contamination from

Animal Lot Management

Fact/Worksheet 8

Keeping Idaho's Water Clean

Why should I be concerned?

Outside animal lots, both surfaced and unsurfaced, are areas where animal wastes concentrate. They can be a source of contamination of surface and ground water. This is especially true if there is no system to divert clean water flow from the animal lot or collect contaminated runoff for diversion to an area where its effect on surface or ground water is minimal.

The potential for animal lots to affect ground water is greatest if the lot is unsurfaced and located over coarse-textured permeable soils, if the water table is at or near the surface, if bedrock is within a few feet of the surface, or when contaminated runoff is discharged to permeable soils and bedrock.

Nitrate-nitrogen levels in drinking water greater than federal and state drinking water standards of 10 mg/L* can pose health problems, including the condition known as methemoglobinemia (blue baby syndrome), for infants under six months of age. Young animals are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/L in the water supply may prove harmful to young animals, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Animal wastes are potential sources of approximately 150 diseases. Illnesses potentially transmited by animal manure include diseases such as typhoid fever, cholera, tuberculosis, and polio. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence suggests that other contaminants can be flowing into ground water. The detection of any coliform bacteria in a drinking water sample is considered as "bacteriologically unsafe."

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

* means milligrams per liter, equivalent to parts per million for water measure

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your animal lot management practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your animal lot management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15–30 minutes to complete the worksheet and to determine your rank.

Glossary

Animal Lot Management

These terms may help you make more accurate assessments when completing Fact/Worksheet 8. They may also help clarify some of the terms used.

Filter strip: A gently sloping grass plot used to filter runoff from the animal lot. Influent waste is distributed uniformly across the high end of the strip and allowed to flow down the slope. Nutrients and suspended material remaining in the runoff water are filtered through the grass, absorbed by the soil, and ultimately taken up by the plants. Filter strips must be designed and sized to match the characteristics of the animal lot and topography.

Holding pond: A storage area, usually earthen, where lot runoff, lagoon effluent, and other dilute wastes are stored before final disposal. It is not designed for treatment.

Infiltration: The downward entry of water into the soil surface.

Percolation: The downward movement of water through the soil.

Runoff control system: A combination of management practices that can be used together to prevent water pollution from animal lot runoff. Practices may include diversion of runoff from the lot, roof runoff systems, lot shaping, settling basins, and filter strips or buffer areas.

Settling basin: Allows separation of liquid and solid wastes by settling out solid wastes for field application or disposal.

Soil drainage class: The conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soils, as opposed to human-altered drainage. Different classes are described by such terms as "excessively drained, well-drained, and poorly drained."

Soil permeability: The quality that enables the soil to transmit water or air. Slowly permeable soils have fine-textured materials, like clays, that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials, like sands, that permit rapid water movement.

Soil texture: The relative proportions of the various soil separates (clay, sand, silt) in a soil. Described by such terms as "sandy loam" and "silty clay."

Improving Animal Lot Management

Keeping Idaho's Water Clean

A major consideration of animal lot management is prevention of pollution. Runoff from animal lots carries manure, soil, chemicals, and other contaminants, and may contaminate surface and ground-water sources. Animal feeding sites can be a potential source of nitrate contamination in homestead water wells. A system is needed for preventing lot runoff from leaving the owner's property, or entering surface or ground water, in a contaminated condition.

Along with addressing the potential of animal lots to contaminate water, other good reasons for improving management practices include improved animal health, ease of maintenance, and enhancing the quality of meat or milk.

1. Distance from well

Wells should be located in an elevated area upslope of the animal lot, so that runoff will not drain into the vicinity of the well. Idaho Waste Management Guidelines encourages a separation of 50 feet between all potential pollution sources associated with existing animal lots and water-supply wells. In general, the farther the animal lot is located from the well, the less likely drinking water will become contaminated.

Minimum separation distances should guide new well installations and the distance from existing wells to new sources of contamination. Make every effort to exceed the requirements and strive to meet current recommendations whenever possible. For more information about separation distances, and how the condition of your well might affect the potential for groundwater contamination, see Fact/Worksheet 1, Drinking Water Well Condition.

Many times, wells are located near animal facilities. If your well is near an animal lot, the best option is to move either the well or the lot to protect your drinking water. In many cases, however, this is not possible — financially or otherwise. Good management, such as keeping the lots clean and preventing any runoff from moving towards the well, can help protect your well water in these situations. Contact a specialist to help you design a system to protect surface and ground-water sources. Plug any abandoned wells on your homestead to eliminate the direct passage they provide for contaminants to reach ground water.

2. Site characteristics

Soil characteristics are one important factor when considering ground-water protection in siting an outside animal yard. Important soil characteristics include surface and subsoil texture, soil depth, permeability, slope, and drainage class. The best site has a deep, well-drained silt loam/clay loam soil with low permeability. A very poor site has shallow soil, a high water table, or a very sandy/gravelly soil with excessive drainage and high permeability. For more assistance in assessing your site's vulnerability to ground-water contamination, see Worksheet A, Site Evaluation.

For existing animal lots on poor sites, the best options for protecting ground water might be eliminating the lot and using total confinement for the animals, or providing paved lots and liquid-tight basins to store lot runoff.

3. Clean water diversion

One way to reduce water pollution from animal lots is to reduce the amount of clean water entering the lot. In all cases, these structures need to be maintained.

- Waterways, small terraces, and roof gutters direct water away from animal lots.
- An earthen ridge or terrace can be constructed across the slope upgrade from an animal lot to prevent runoff from entering the lot.
- In some areas, if a diversion terrace is not practical, a catch basin with a tile outlet could be installed above the animal lot.

Careful site selection can minimize or eliminate the provisions needed to divert clean water away from the lot.

4. Runoff control systems

An outside animal lot without a runoff control system typically has an earthen surface compacted by animal traffic. This surface is not shaped for water drainage, so it is sometimes dry and sometimes muddy. Manure typically accumulates on the surface, and decaying manure is mixed into the soil by animal traffic.

Such a lot is difficult to manage, and the absence of runoff controls may lead to water quality problems. Runoff from adjacent cropland, pasture, roads, or building roofs can flush manure from the lot, possibly entering nearby bodies of surface water, or creating mud holes.

Contaminated runoff from an active feedlot that accumulates in areas adjacent to the lot may flow through the soil and threaten ground-water quality. This risk is particularly high on sites with high infiltration and percolation rates, such as sandy soils and other soils with good-to-moderate drainage.

Runoff control systems can remedy such problem situations. Figure 1 shows how curbing around an animal lot collects and channels runoff to a waste storage pond. After collection, runoff can be evenly applied to open grassed areas or filter strips, away from streams, ditches, waterways, and areas of permeable soils and creviced bedrock. Another option is to collect animal lot runoff, settle out manure solids, and direct the remaining water to holding ponds which collect and store runoff for later land application (*Figure 2*).

The need for runoff control facilities is dependent on several factors related to the size and type of animal operation as well as surface characteristics and management practices of the operation. Some operations, due to size and management, may not need structural controls.

The Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ) is the state agency responsible for administering surface and ground-water pollution control laws. The U.S. Environmental Protective Agency (EPA) is responsible for the permit program for dairy farms that discharge pollutants to surface or ground water. Other concentrated animal feeding operations may require waste discharge permits, depending upon site-specific circumstances. More information is available by contacting the DEQ regional office in your area (see Contacts and References section).

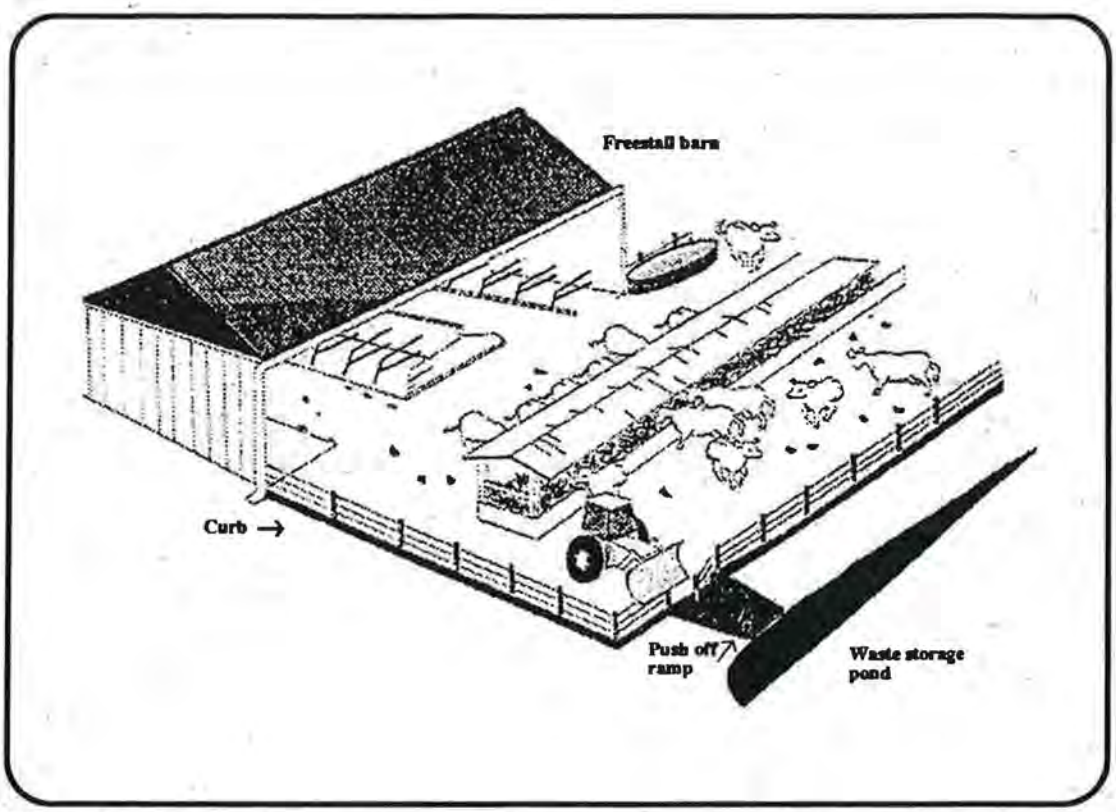

***Figure 1*: Confinement area with curbing.** *Source: Animal Waste Management Field Hand book, U. S. Department of Agriculture-Soil Conservation Service, 1992.*

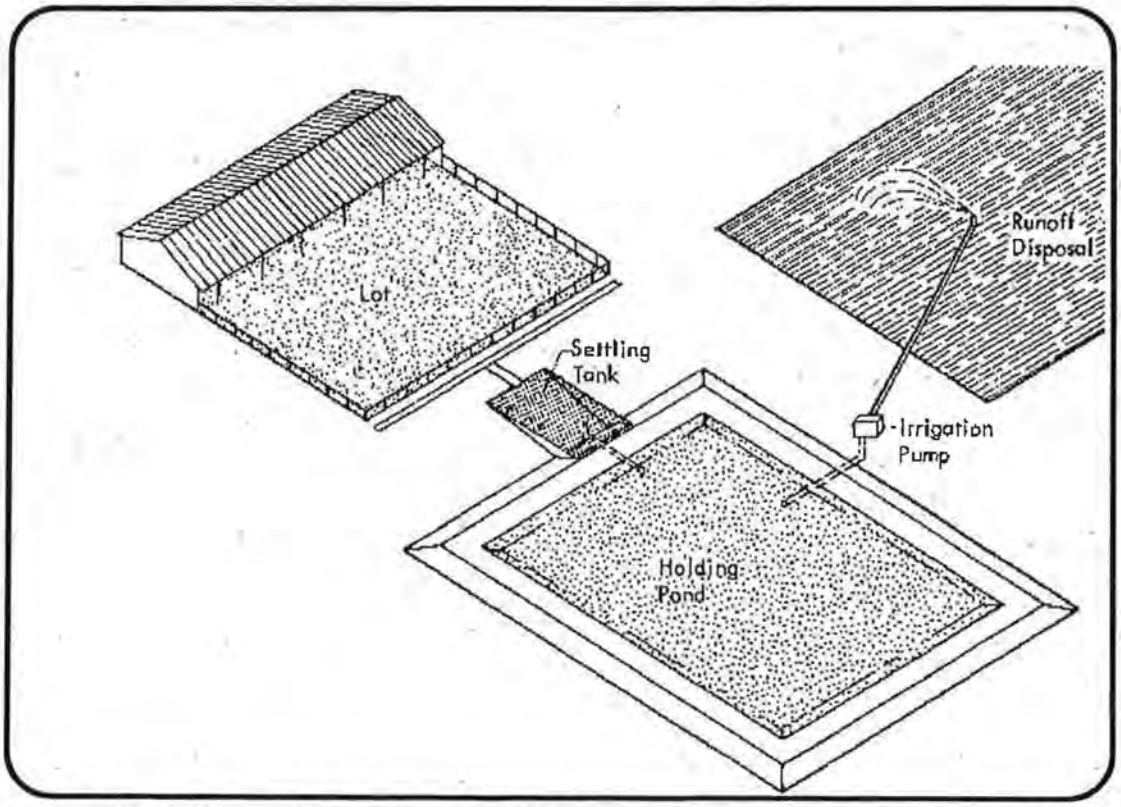

***Figure 2:* Detention pond for storage of animal lot runoff.** *Source: Dairy Housing and Equipment Handbook, MWPS-7, Midwest Plan Service, Ames, Iowa.*

5. Collection of manure from lots

Manure collection should be accomplished through "manure harvesting" rather than by "cleaning pens." Collect manure from animal lots regularly. The amount of manure on an animal lot depends on the number of animals and the hours per day animals spend on the lot. Scrape open lots at least twice per year. Heavy concentrations of animals will require more frequent manure removal.

The type of lot surface also affects lot management. Concrete surfaces are easier to scrape than earthen lots. Earthen lots are scraped when dry, so manure may be removed less frequently.

Lots should not be cleaned to bare dirt, but they often are. When earthen lots are scraped, a thin layer (1 to 2 inches) of manure pack should be left to seal the surface of the lot. Water moves very slowly through this compacted layer, minimizing the potential for leaching of nitrates and bacteria through the soil to ground water. Collect all the manure from a lot when the lot is either no longer going to be used, or when it is to be left empty for an extended period of time.

6. Concentration of animals and type of lot surface

The area needed per animal for minimizing the risk of ground-water contamination depends on the type of lot surface, lot slope, amount of rainfall, and other lot management factors. The amount of concrete surface area needed per animal is much less than that required for an earthen lot.

The concrete area needed is a balance between traffic on the lot and resting area provided for animals. Too large an area can result in manure freezing to the surface for long periods, while too small an area will result in animals having difficulty moving about. At least 50 square feet of concrete area per head is recommended for a cattle feedlot. Facilities for growing-finishing pigs in lots with open-front sheds should provide 12 to 15 square feet of outdoor lot space per pig.

For beef cattle operations, open feedlots are usually unpaved. Recommended slopes for good drainage are two to four percent. Minimum space recommendations are 150 to 250 square feet per head with four percent or greater slopes; 250 to 400 square feet with two to four percent slopes; and 400 to 800 square feet with slopes less than two percent.

Mounds improve drainage and provide areas that dry quickly. Feedlot mounds should be about three to four feet high with five to one side slopes (horizontal to vertical). Mounds can be built down the center of the lot or at the fence line with half of the mound in adjacent pens. Besides improving drainage conditions, mounds provide a wind break from cold winds.

Lot management involves considerations other than surface and ground-water protection. In addition to decreasing the chance for ground-water contamination, a well-drained, dry lot improves animal comfort, health, and feed utilization. A combination of lot surfaces offers the most flexibility in adapting to weather conditions. Animal location can be chosen based on the amount of mud in the lot — on concrete in sloppy conditions, on an earthen surface in dry weather, and on a mound in intermediate conditions.

If bedrock is close to the surface where your animal lot is located, pave the surface with concrete, or totally confine animals.

7. Animal manure storage and utilization

In addition to the condition and management of your animal lots, your farm animal manure management should plan for manure storage and utilization. *Fact/Worksheet 7, Animal Manure Storage*, provide guidelines for minimizing the impact of animal manure storage practices on ground water.

Animal manure can be a valuable fertilizer and soil conditioner. When managed properly, the nutrients in manure can be substituted for commercial fertilizers, saving money, and protecting surface and ground water. Matching nutrient applications to crop nutrient needs is critical. *Fact/ Worksheet 7* and the *Livestock Waste Facilities Handbook,* MWPS-18, provide more information on land application and utilization of animal wastes.

8. Abandoned animal lots

On active feedlots, the layer of organic matter mixed with soil at the surface lies over compacted subsurface soil, forming a layer through which water moves very slowly. Therefore, leaching of nitrate and bacteria through the surface seal and compacted layers is not likely within the animal lot. If animal lot runoff is discharged to permeable soils or bedrock, leaching may occur. Studies have found little nitrate in the soil beneath active feedlots. Nevertheless, abandoned lots can pose a particular ground-water contamination risk. As the manure pack breaks up from lack of use, water can leach through and carry nitrates to ground water.

If you have a permanently abandoned lot, dig it up, spread the manure and soil combination on fields, and refill the former lot with other material. Another option is to till and plant the lot to a high-nitrogen-using crop, which will use the nitrogen released by soil and the manure decomposition process. Remove manure from a feedlot that will not be used for an extended period. Otherwise, cracks developing in the surface may allow leaching of nitrates into the ground water.

Worksheet 8

Animal Lot Management: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right, and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Complete section "What do I do with these rankings?"
5. Allow about 15–30 minutes to complete the worksheet and figure out your risk of drinking water contamination.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION (Addressed in *Section 1*)					
Distance from drinking water well to lot	More than 400 feet.	200–400 feet.	50–200 feet.	**Less than 50 feet.***	____
Position of lot in relation to drinking water well	Downslope from well. No lot runoff reaches well.	At grade with well. No lot runoff reaches well.	Upslope from well. Some lot runoff may reach well.	Upslope from well. Lot runoff reaches well.	____
SITE CHARACTERISTICS (Addressed in *Section 2*)					
Soil depth and permeability	Well-drained medium or fine-textured soils (loam, silt loam, clay loams, clays) with low permeability (silt and clay). Soils more than 40 inches deep with low permeability (silt and clay).	Well-drained or moderately well-drained medium to fine-textured soils (loam, silt loam, clay loams, clays). Soils which are 30-40 inches deep with moderate permeability (loamy).	Moderately well-drained coarse-textured soils (sands, sandy loam). Soils which are shallow (20-30 inches) and/or highly permeable (sandy).	Coarse-textured soils (sands, sandy loam) excessively well drained to gravel or somewhat poorly to poorly drained soils. Soils which are very shallow (less than 20 inches) and/or have very high permeability (coarse sand).	____

Boldface type in high-risk column: Besides representing a higher-risk choice, this practice also violates Idaho law.

*Check with the Idaho Department of Water Resources for installation requirements. Existing wells must meet separation requirements in effect at time of construction.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
DESIGN AND MANAGEMENT (Addressed in *Sections 3-5, and 8)*					
Surface water diversion	All upslope and roof water diverted.	Most upslope surface and roof water diverted.	No surface water diverted. Some roof water collected and redirected.	All water (surface and roof water) runs through the lot.	____
Lot runoff control system	No lot runoff (animals confined to building or on pasture).	All runoff collected from lot. Solids separated for handling. Water directed onto filter strip or into holding pond for proper field application.	Most of lot runoff collected. Some solids removed. No filter strip. Holding pond with excessive seepage or frequent overflows.	Lot runoff uncontrolled.	____
Lot cleaning and scraping practice*	No lot (animals confined to building or on pasture).	Once per month or more.	Seasonally. At least twice per year.	Rarely. Once per year or less.	____
Abandoned lots or lots not used for extended periods of time.	No abandoned or unused lots on homestead.	Any permanently abandoned lot dug up and field applied or planted to high-nitrogen-using crop. Manure removed from temporarily unused lot.	Temporarily unused lot not cleaned.	Permanently abandoned lot not cleaned up or planted to cover crop.	____
CONCENTRATION OF ANIMALS ON LOT [*square feet per animal (sf/a)*]** (Addressed in *Section 6)*					
Beef feeders	No lot. Confined to barn or pasture.	Barn and/or paved lot more than 50 sf/a. Earthen lot with mound more than 300 sf/a, or without mound more than 500 sf/a.	No shelter and paved lot 40-50 sf/a. Earthen with mound more than 150 sf/a or earthen without mound more than 250 sf/a.	Paved less than 40 sf/a, or earthen less than 150 sf/a.	____

*Heavy concentrations of animals require more frequent cleaning of lots.
**Animal concentrations derived from Midwest Plan Service publications and other sources.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
CONCENTRATION OF ANIMALS ON YARD [*square feet per animal (sf/a)*]*					
Beef cows/heifers	No lot. Confined to barn or pasture.	Barn with paved lot more than 60 sf/a. Earthen with mound more than 400 sf/a. Earthen without mound more than 600 sf/a.	Paved lot more than 30 sf/a. Earthen with mound more than 200 sf/a Earthen without mound more than 300 sf/a.	Earthen without mound less than 300 sf/a.	____
Hogs/sows	No lot. Confined to barn.	Shed and paved lot more than 30 sf/a.	Shed and earthen lot more than 15 sf/a.	Shed and earthen lot less than 15 sf/a.	____
Pigs: growing/ finishing	No lot. Confined to barn.	Shed and paved lot more than 15 sf/a.	Shed and earthen lot more than 15 sf/a.	Shed and earthen lot less than 15 sf/a.	____
Sheep/ewes	No lot. Confined to barn or roofed area.	Barn and paved lot more than 20 sf/a. Earthen more than 40 sf/a.	Barn and paved lot less than 20 sf/a. Earthen more than 15 sf/a.	Earthen less than 15 sf/a.	____
Feeder lambs	No lot. Confined to barn.	Barn and paved lot more than 10 sf/a. Earthen more than 25 sf/a.	Barn and paved lot more than 5 sf/a. Earthen more than 10 sf/a.	Earthen less than 10 sf/a.	____
Dairy cows	No lot. Confined to barn or roofed area.	75 sf/a or more on fenced, curbed concrete pad and/or 400 sf/a on graded earthen surface. More than 1,800 sf/a in exercise area.	50 sf/a or more on concrete and/or 150-400 sf/a on earthen surface. More than 1,200 sf/a in exercise area.	Some concrete (less than 50 sf/a) and earth (less than 150 sf/a).	____
Dairy replacements	No lot. Confined to barn or roofed area.	More than 40 sf/a on fenced, curbed concrete pad and/or 150-200 sf/a on earthen lot.	More than 20 sf/a on concrete and/or more than 75 sf/a on earthen surface.	Less than 75 sf/a on earth.	____

*Animal concentrations derived from Midwest Plan Service publications and other sources.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
CONCENTRATION OF ANIMALS ON YARD [square feet per animal (sf/a)]*					
Horses	No lot. Confined to barn or on pasture.	Earthen exercise lot more than 2,500 sf/a. No pasture.	Earthen lot more than 1,250 sf/a. No pasture.	Earthen lot less then 1,250 sf/a. No pasture.	_____
Chickens:					
Broilers	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 2 sf/a or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 2 sf/a or more, on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	_____
Layers	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 4 sf/a or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 4 sf/a or more, on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	_____
Turkeys	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 8 sf/a or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 8 sf/a or more, on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	_____

*Animal concentrations derived from Midwest Plan Service publications and other sources.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Animal Lot Management Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Distance from well to lot				
Position of lot to well				
Soil depth and permeability				
Surface water diversion				
Lot runoff control				
Lot cleaning and scraping				
Abandoned/unused lots				

Animal concentrations:

Beef feeders				
Beef cows/heifers				
Hogs/sows				
Pigs				
Sheep/ewes				
Feeder lambs				
Dairy cows				
Dairy replacements				
Horses				
Chickens: Broilers				
Layers				
Turkeys				

Step 2: Look over your rankings for individual activities.

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Technical standards and design assistance

• Your local Soil Conservation District, Natural Resources Conservation Service, Cooperative Extension System, or Idaho Department of Health and Welfare-Division of Environmental Quality regional office.

Sources of information about financial assistance

• Your county Farm Service Agency, Soil Conservation District, Natural Resources Conservation Service, or Cooperative Extension System office.

Registration, permit, and certification for animal manure control facilities

• Contact the Division of Environmental Quality regional office for your area:

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

• Contact your County Planning and Zoning Commision for any local regulations pertaining to securing new permits.

What to read about...

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.

Ground water contamination, protection, and testing

• *Washington Agriculture-Sustaining Water, Land and People* EB1634 (1)
• *Regulation and Control of Odors from Livestock Facilities* EB1184 (1)
• *Washington Groundwater: A Vital Resource* EB1622 (1)
• *Protecting Groundwater: Managing Livestock on Small Acreage* EB1713 (1)
• *Managing Livestock Manure to Protect Groundwater* EB1717 (1)
• *Animal Manure Data Sheet* EB1719 (1)
• *Defining Water Quality* EB1721 (1)

A list of laboratories certified to conduct water sample analysis is available from your Cooperative Extension System agent or local public health district.

Design criteria and general information

• *Agricultural Waste Management Field Handbook.* Soil Conservation Service, 1992. (3) A comprehensive guide addressing animal management and resource protection.
• *Beef Housing and Equipment Handbook.* Midwest Plan Service. MWPS-6 (2) Summarizes current agricultural engineering recommendations for beef producers. Discusses building design and operation, and necessary equipment. Includes building construction, manure management, farmstead planning, and feed storage.

• *Idaho Waste Management Guidelines for Confined Feeding Operations DEQ.* Provides complete guide for waste management in confined feeding operations.
• *Sheep Housing and Equipment Handbook.* Midwest Plan Service. MWPS-3. (2). Provides information for planning an efficient sheep system. Sections include materials on managing facilities, building layouts, treating and handling facilities, and manure management.
• *Swine Housing and Equipment Handbook.* Midwest Plan Service. MWPS-8. (2). Complete guide to swine building design, operation and equipment. Includes discussions of site selection, remodeling, and solid and liquid manure handling.
• *Dairy Housing and Equipment Handbook.* Midwest Plan Service. MWPS-7. (2). Presents dairy facility and equipment planning and design. Includes discussions of milking centers, manure management, silo capacities, and basic farmstead planning principles.
• *Livestock Waste Facilities Handbook.* Midwest Plan Service. MWPS-18. (2). Emphasizes planning and design of livestock waste facilities and equipment. Chapter discussions include animal waste characteristics, collection and transport to storage, open lot waste handling, land application techniques, and waste use. Extensive worksheet helps producers determine manure application rates for their system.

Publications available from...

• Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
• Your county Cooperative Extension System office or the Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.
• Idaho Division of Environmental Quality (DEQ) regional offices.

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Silage Storage

Keeping Idaho's Water Clean

Fact/Worksheet 9

Why should I be concerned?

Silage is an important feed for animal-based agriculture. When properly harvested and stored, silage poses little or no pollution threat. Improper handling and inclement weather, however, can lead to a significant flow of silage juices (or leachate) from the silo. Leachate is an organic liquid that results from pressure in the silo, putting up feed that is too wet, or from extra water entering the silo. It is usually a problem only when silage is fresh or just after it is stored in covered silos. Storage in uncovered silos is not recommended, because exposure to the weather accelerates the decrease of silage quality. Loss of leachate represents a major loss of nutrient value from the silage.

If silage leachate enters a stream, its high organic content feeds bacteria that rob the water of oxygen. The capacity of a contaminant to rob water of oxygen is called biochemical oxygen demand (BOD). The BOD of silage effluent is 150 times greater than that of human sewage. BOD from one ton of silage with a moisture content of 23.4% is equal to approximately 4,755 gallons of sewage. Ground water contaminated with silage juices has a disagreeable odor and shows increased acidity, ammonia, nitrate, and iron.

Silage liquid is often highly acidic and can be corrosive to concrete and steel. In addition to the pollutants found in silage leachate, an even greater potential threat exists. The low pH created by the presence of acids in silage leachate can free up and release naturally occurring metals in the soil and aquifer, which can increase metal concentrations in ground water.

Nitrate-nitrogen levels in drinking water greater than federal and state drinking water standards of 10 mg/L* can pose health problems, including the condition known as methemoglobinemia (blue baby syndrome), for infants less than six months of age. Young animals are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/L in the water supply may prove harmful to young animals, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

*means milligrams per liter, equivalent to parts per million for water measure

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your silage storage practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your silage storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 5. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Improving Silage Storage

Keeping Idaho's Water Clean

1. Silage moisture content

Silage is the conversion of a wet, unstable forage product to a wet, fermented, and stable forage product. Silage can be made from corn and other forage crops, such as grass and alfalfa. The amount of leachate (silage juices) produced varies with the material stored, its moisture and nitrogen content, and handling and storage conditions. Of these, moisture is the most crucial.

Research indicates that materials stored at 70 percent moisture content or higher can produce leachate. For corn silage, the amount produced varies from a trickle at 75 percent moisture to 79 gallons per ton at 85 percent moisture. About three-quarters of the leachate is produced in the first three weeks of storage, although it can continue to flow for up to three months.

Farmers can use several methods to reduce leachate production from silage. The most effective of these is to vary cutting and harvesting times, allowing the material to dry down or wilt in the field (*Figure 1*). Although this may not always be possible, it can reduce leachate production by 100 percent. Other methods include cutting or crimping the materials or adding moisture-absorbent materials to the silage as it is stored. Adding absorbent materials not only reduces leachate, but can also raise the nutrient value of the silage. Materials to use include alfalfa hay or cubes, beet pulp, rolled barley, ground corn, newsprint, and bentonite clay. Most of these

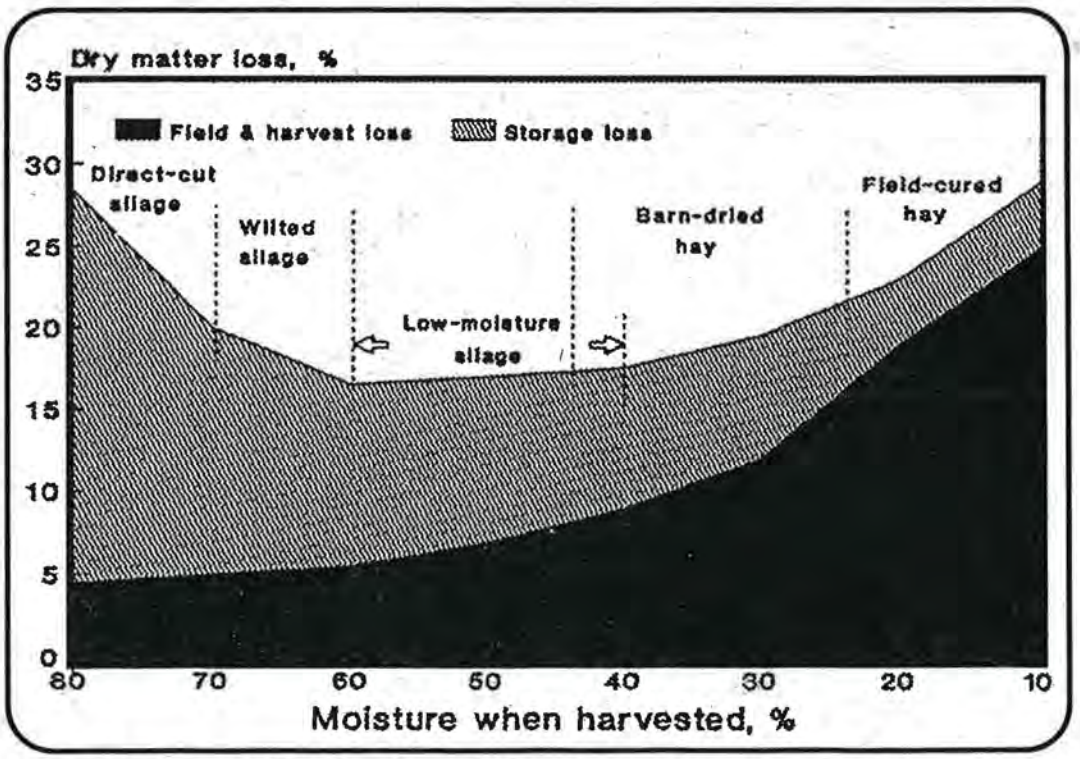

***Figure 1*: Estimated total field and harvest loss and storage loss when grass or legume forages are harvested at varying moisture levels and by alternative harvesting methods.** *Source: Forages: The Science of Grassland Agriculture, 1980.*

materials will absorb from one to 200 times their weight in water. To be effective, enough must be added to absorb the anticipated leachate.

2. Silage storage

The crop is allowed to field wilt to the proper moisture content before chopping to ensure proper ensiling. Silage with a higher moisture content is usually put into horizontal silos. High-moisture silage and haylage may produce significant amounts of silage juice. A system for collecting any leachate is needed in these situations.

Although many older silos may have dirt floors and may have been dug into the subsoil three to six feet below ground level, new silos are built with concrete foundations and floors. Bunker, pit, or trench silos on bare ground present a greater risk to ground water.

3. Silo location

To prevent possible water contamination, silos should be located as far away from wells and surface water sources as practical. Silos should be located downslope from wells and surface water whenever possible. State regulations require that any potential contaminant source be located at least 50 feet away from any water supply well. Proper location will also prevent silage juices from entering surface water sources.

Minimum separation distances should guide new well installations. Make every effort, however, to meet or exceed current recommendations whenever possible. This will help to assure protection of your well water from contamination.

4. Silo design and construction

Most tower silos being built today have concrete interiors. They are built on concrete foundations, with a drain near the base to allow venting of pressure that may develop.

Silage bags are increasing in popularity in the Pacific Northwest. They can be used to store silage varying widely in moisture percentage. Leachate can pool in the bottom of the bag and leak out when the bag is opened or ripped accidently. The floor of an area used to store bags of silage should be graded, so leachate moves to a lagoon. Most silage bags are used only one time and then discarded.

Horizontal trench silos excavated into the ground may affect ground water, especially in coarse soils and sites close to the water table. Properly compacted clay soils and concrete floors can limit leachate seepage.

The type of silo on your farm often has less effect on the potential to contaminate ground water than the condition of the silo. For example, an old wooden silo with an earthen floor may pose a higher risk than a bunker silo with a concrete floor (*Figure 2*). However, older structures can be re-lined to make them relatively watertight.

Silo caps or covers keep rain water from entering the silage, preserving a quality silage, and reducing weather loss and spoilage. They also reduce the potential for producing leachate. Horizontal silos should be covered with a plastic sheet. Tires can be used to keep the cover in place.

It is important to divert clean water away from new and existing silage storage structures. Diverting clean water away from silage in vertical and horizontal silos can protect surface and ground water.

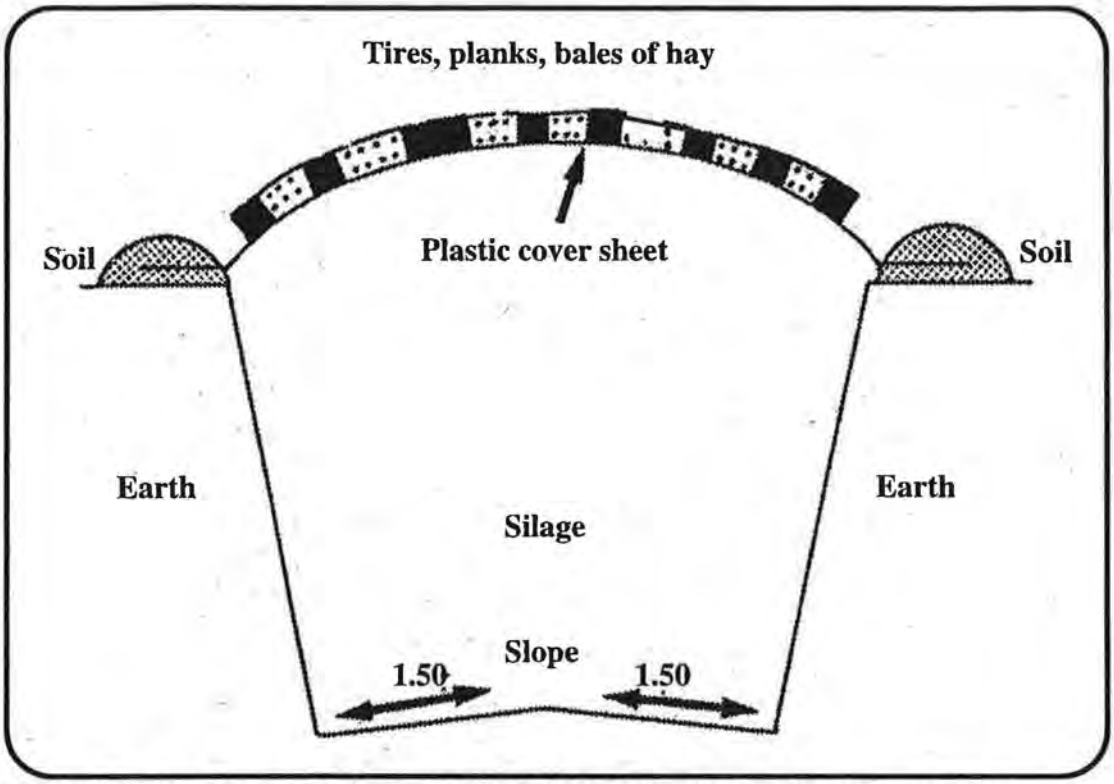

Figure 2: **Basic silage trench.** *Source: Field Guide for Hay and Silage Management in North America, 1991.*

5. Leachate collection and use

Leachate can be collected from tower, trench, and horizontal silos by channeling the liquid into a water retention structure, usually a pond or lagoon lined with concrete, clay, or plastic. Drain tiles around tower silos can be used to collect any seepage from the silo. Horizontal silos use channels to direct seepage into a collection area. Contact the Natural Resources Conservation Service (NRCS) for assistance with design.

Nitrogen in leachate has significant fertilizer value if applied during spring or early summer. Because of its high ammonia content, leachate can burn grasses and remove oxygen from the soil. Farmers who consider spreading leachate on land should consult a soil specialist to determine how much leachate can be safely spread on each field.

Worksheet 9

Silage Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and figure out your risk rank for silage storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Silage moisture content	Less than 65%. Wilted silage.	Between 65% and 75%.	Between 76% and 85%.	More than 85%. Direct-cut.	____
Silage storage location	At least 100 feet downslope (bunker or trench). Water drains away from storage to field or pasture.	At least 100 feet downslope from well (silos, plastic tubes). At least 250 feet downslope (bunker or trench). Water drains to field or pasture.	Within 50 feet of well Within 500 feet upslope (bunker or trench). Water pools or stands near storage.	Within 50 feet of well (silos, plastic tubes). Within 250 feet (earthen trench). Water pools on soil surface.	____
Silage storage floor or surface condition	Concrete or asphalt surface. No cracks.	Concrete or asphalt surface with some cracks or compacted clay soil surface.	Surface has some permeable soils (silt loam) and has some cracks.	Surface has permeable soil (sand), not compacted.	____
Silage storage cover condition	Roofed or tight fitting cover. No leaks.	Cover tight-fitting (tower silo). Minor leaks repaired. Plastic covering tight (bunker or trench).	Cover, but many large leaks not repaired (tower silo, bunker, or trench).	No cover.	____
Leachate collection system	Designed system in place and maintained.	Designed system in place but not maintained.	No system in place. Temporary management measures employed.	No system in place. Leachate collects in low area **or moves to waterway.**	____
Silo absorbents	Always used.	Frequently used.	Periodically used.	Not used.	____

***Boldface type*:** Besides representing a higher-risk choice, this practice violates Idaho law.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Silage Storage Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Silage moisture content				
Silage storage location in relation to well				
Silage storage floor or surface condition				
Silage storage cover condition				
Leachate collection system				
Silo absorbents				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action . The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Silo design and construction

• Your local Natural Resources Conservation Service (NRCS), county Cooperative Extension System office, or Extension agricultural engineer, (208) 885-6182.

Leachate control planning and design

• Your county Cooperative Extension System, NRCS, or Soil Conservation District office.

What to read about...

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.

Planning and design criteria, general information

• *Field Guide for Hay and Silage Management in North America,* 1991. Published by the National Feed Inde-gredients Association, this document is an extensive, practical reference on hay and silage managment. (1)
• *Silage Managment in Queensland,* 1984. This Australian publication contains a wealth of information on silage, including growing, harvesting, ensiling, and feeding out to animals. QI83028. (3)
• *Dairy Housing and Equipment Handbook.* Midwest Plan Service. MWPS-7. (2)
• *Beef Housing and Equipment Handbook.* Midwest Plan Service. MWPS-6. (2)
• *Farm and Home Concrete Handbook.* Midwest Plan Service. MWPS-35. (2)
• *Tilt-Up Concrete Horizontal Silo Construction.* AED-15. (2)

Publications available from...

• Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
• Your county Cooperative Extension System office or the Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Milking Center Wash Water Treatment

Fact/Worksheet 10

Keeping Idaho's Water Clean

Why should I be concerned?

Dairy wash water is usually considered a dairy sanitation problem. If not carefully managed, however, dairy wash water can contaminate both surface and ground-water sources.

The amount of wash water generated varies with milking preparation, equipment used, and the number of cows. A 100-cow, free-stall operation may use anywhere from 100 to 1,000 gallons of water per day in the milking center alone.

Milking center wash water is contaminated with organic matter, nutrients, chemicals, and microorganisms. Poorly designed or mismanaged waste water disposal systems can contaminate surface and ground water with ammonia, nitrate, phosphorus, detergents, and disease-causing organisms. Surface water can also be contaminated by manure, milk solids, ammonia, phosphorus, and detergents.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

- It will take you step-by-step through your milking center wash water treatment system.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand risk rankings that will help you analyze your milking center wash water treatment practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Glossary

Milking Center Wash Water Treatment

These terms may help you make more accurate assessments when completing Fact/Worksheet 10. They may also help clarify some of the terms used.

Land application: Application of wash water to croplands and pastures by irrigation equipment or a liquid manure spreader.

Slow surface infiltration: Application of wash water at one end of a gently sloping grass filter strip or terrace so that it is treated as it slowly flows through the plant-soil system. A portion of the flow percolates to ground water, and some is used by vegetation.

Soil permeability: The quality that enables the soil to transmit water or air. Slowly permeable soils have fine-textured materials, like clays, that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials, like sands, that permit rapid water movement.

Improving Milking Center Wash Water Treatment

Keeping Idaho's Water Clean

Wash water from the dairy milking center includes wastes from the milking parlor (manure, feed solids, hoof dirt) and milk house (bulk tank rinse water and detergents used in cleaning).

From an environmental perspective, delivery of milking center wash water to a liquid manure storage facility, if available, makes the most sense. Dewatering options include overland flow and slow surface infiltration. Solids separators also reduce liquids. Overland flow is the more effective option.

Your drinking water is least likely to be contaminated if you follow appropriate Best Management Practices (BMP's). If you choose to dispose of excess wash water **off the farm**, use proper off-site disposal practices to avoid contamination that could affect the water supplies and health of your family and others.

1. No discharge by combining wastes

Combining milking center wash water with manure has the advantage of allowing a common disposal system for both types of waste. A liquid manure storage facility, properly constructed and sized, provides the additional flexibility of storing wastes until they can be applied at the right time to the right sites at suggested agronomic rates (*Figure 1*).

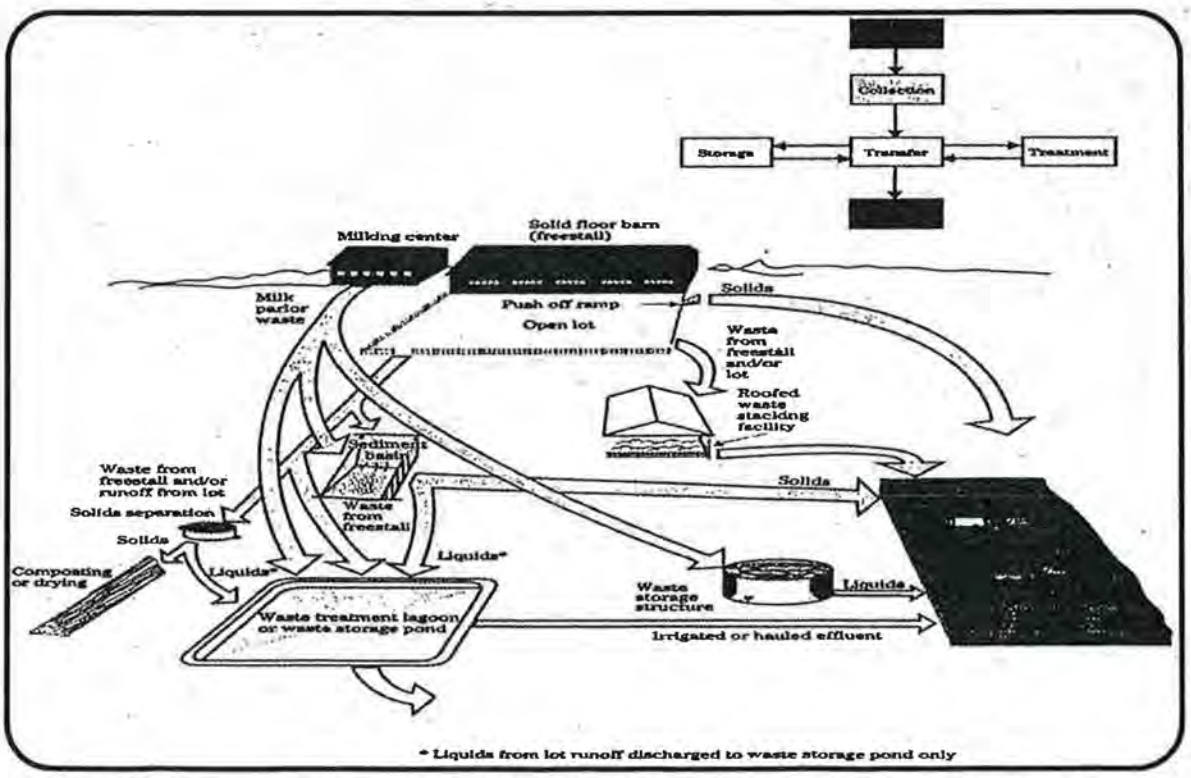

***Figure 1*: Wash water and manure handling options for dairy farms.** *Source: Agricultural Waste Management Field Handbook, USDA-Soil Conservation Service, 1992.*

Applying milking center waste water with manure to fields at rates that do not exceed crop needs for nitrogen reduces the risk of ground-water contamination from either wastes. Care must be taken, however, to keep soil phosphorus levels from accumulating to levels that will harm crops. On steep land, application rates must be closely monitored to prevent wash water and manure, along with eroding soil, from contaminating nearby streams and lakes.

Milking center wash water combined with runoff from solid manure storage or animal lots can be stored in a detention pond. The contents of the pond can be applied to fields when conditions are appropriate. Site conditions that need to be considered before land application include weather, soil moisture, nutrient requirements of present and future crops, and the farm management plan.

2. Treatment before discharge

While soil and plant systems have a large capacity to absorb and use wastes, treating wash water to remove some wastes before it gets into the soil can extend the effective life of a soil application area. Such pretreatment usually consists of a basin that holds the wash water long enough for heavier particles to settle and lighter solids to float.

A settling lagoon also provides a place for bacteria to decompose some wastes before disposal (*Figure 2*). This process causes a scum to form on top of the liquid in the basin lagoon.

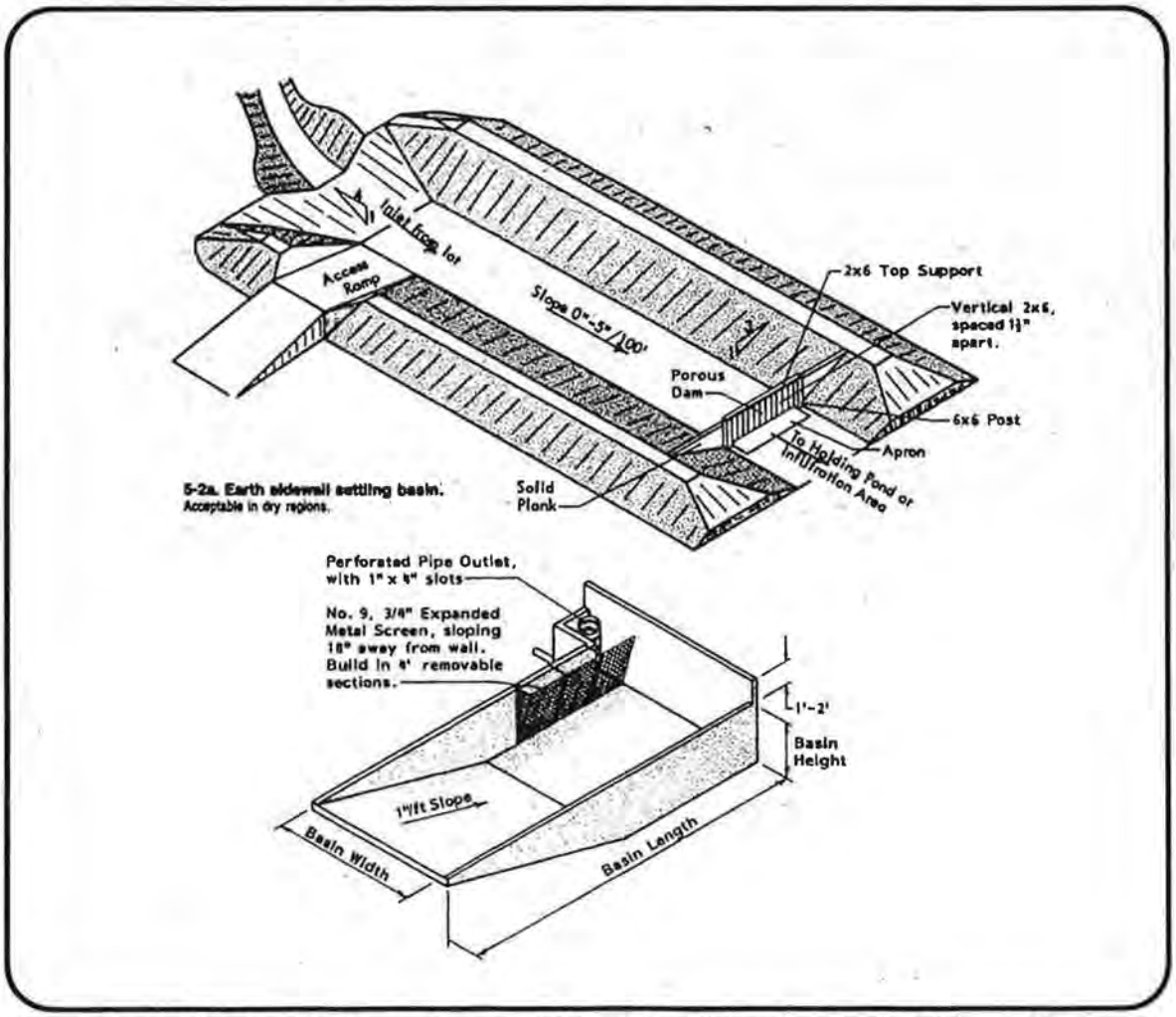

Figure 2: **Settling basins.** *Source: Livestock Waste Facilities Handbook, Midwest Plan Service, 1985.*

If a mechanical separator is used initially to remove the larger particles, a smaller settling basin may suffice. Removing waste products before washing into a settling basin requires extra effort, but it reduces the rate of solids accumulation, which can extend the period between basin cleanouts. Manure and excess feed, for example, can be treated like, and thus combined with, other animal wastes.

Passing wash water through a shallow treatment pond (also called an aerobic lagoon) results in a more thorough pretreatment. Algae growing in the pond generate oxygen, which can help decompose organic compounds without creating obnoxious odors. Mechanical aerators also may enhance aerobic action, but may cause noxious odors.

Solids that settle to the bottom of the pond usually decompose in the absence of oxygen. To prevent ground-water contamination, such ponds must be built of an impervious material such as packed clay or concrete, or synthetic liner. In some cases, wash water can be discharged to a lagoon without first going through a settling tank. After settling, the waste is best applied at low rates to croplands. Be aware that decomposition processes in this arrangement may generate odors.

Solids from settling basins are an excellent source of organic matter. Gardeners without access to manure can use the solids to improve top soil.

3. Land application methods

Treating wash water for direct discharge to a stream or lake is too expensive for most dairy farms. The soil provides the most cost-effective treatment and use of wastewater. Direct, daily discharge is not recommended because it will result in application to frozen, saturated, or snow-covered soil. Several methods are available, however, for dewatering and using wash water from retention and treatment structures. Two options are approved for use in Idaho:

- Direct cropland application
- Use in composting operations

Applying wash water to cropland at low application rates poses the least potential for surface or ground-water contamination. The soil can assimilate the dispersed manure and crops can use some of the nutrients, thus preventing nutrients from entering surface or ground water.

Any methods that involve application of wash water or manure to the soil surface should be preceded by a soil analysis and a plan for use of these nutrients by crops. These applied nutrients should be credited in your fertilizer program.

Field application

Dairy wash water can be applied to croplands and pastures with portable irrigation equipment or a liquid manure spreader. Field application timing and rates should be based on site-specific factors, such as soils, the crops to be grown, topography, flood hazard, and proximity to water bodies.

Milking center wash water applied to cropland at agronomic rates reduces the danger to ground water because the soil filters or plants take up potential contaminants. Wash water and manure should be incorporated into the soil whenever possible. Avoid land application of wastes within 200 feet of water courses or water bodies, or in flood plains during flooding seasons unless incorporated. Do not saturate soils, as this can allow rapid percolation to ground water or runoff to surface water. To maximize the efficiency of this system, harvest the crop or other vegetation. Windbreak or woodlot application may also be suitable, in which case harvest is not needed.

Slow surface infiltration

Wash water can be applied at one end of a gently sloping grass filter strip or terrace. By spreading **pretreated** wash water over a vegetated soil surface, organic compounds and bacteria can be treated or filtered out as wastes flow in sheet form over the sloped, vegetated soil surface and percolate through the soil (*Figures 3 and 4*). Precipitation could overwhelm this system. This system works best on well-drained, loamy soils with at least four feet to bedrock or ground water. The area should be designed to minimize runoff during heavy rain or snowmelt.

A controlled system of distribution and flow is required. Managing wash water safely requires that the waste storage lagoon and land application area be large enough to handle wastes during periods when land application is unacceptable. Harvesting the infiltration area is needed to keep vegetation from decomposing and releasing nutrients that have the potential for ground-water contamination.

Properly operated, a slow infiltration system poses a moderate risk of ground-water contamination from nitrate and other soluble compounds. There is a low risk of contamination from organic matter, pathogenic (disease-causing) microorganisms, phosphorus, or detergents.

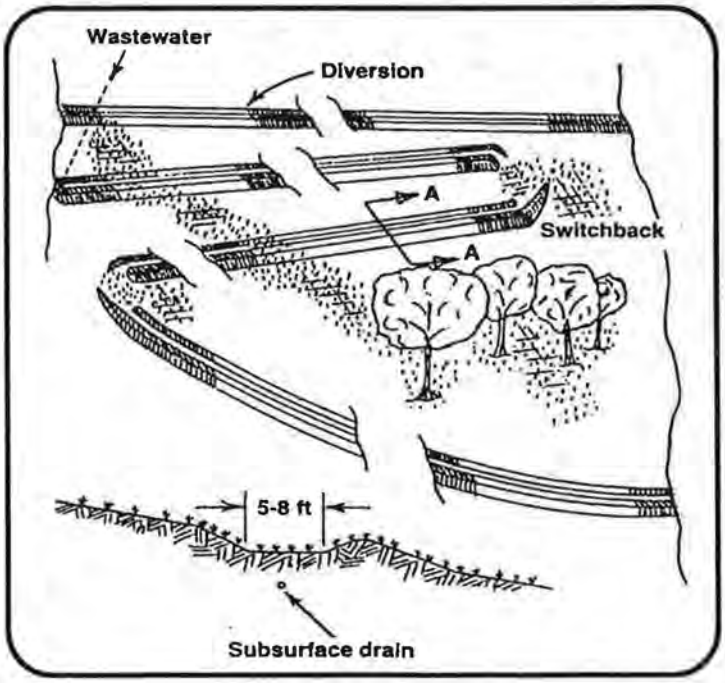

***Figure 3*: 1 to 2% infiltration terrace.** *Source: Milking Center Wastewater Disposal, Manure Management for Environmental Protection, Document DM7, Pennsylvania Department of Environmental Resources, October 1986.*

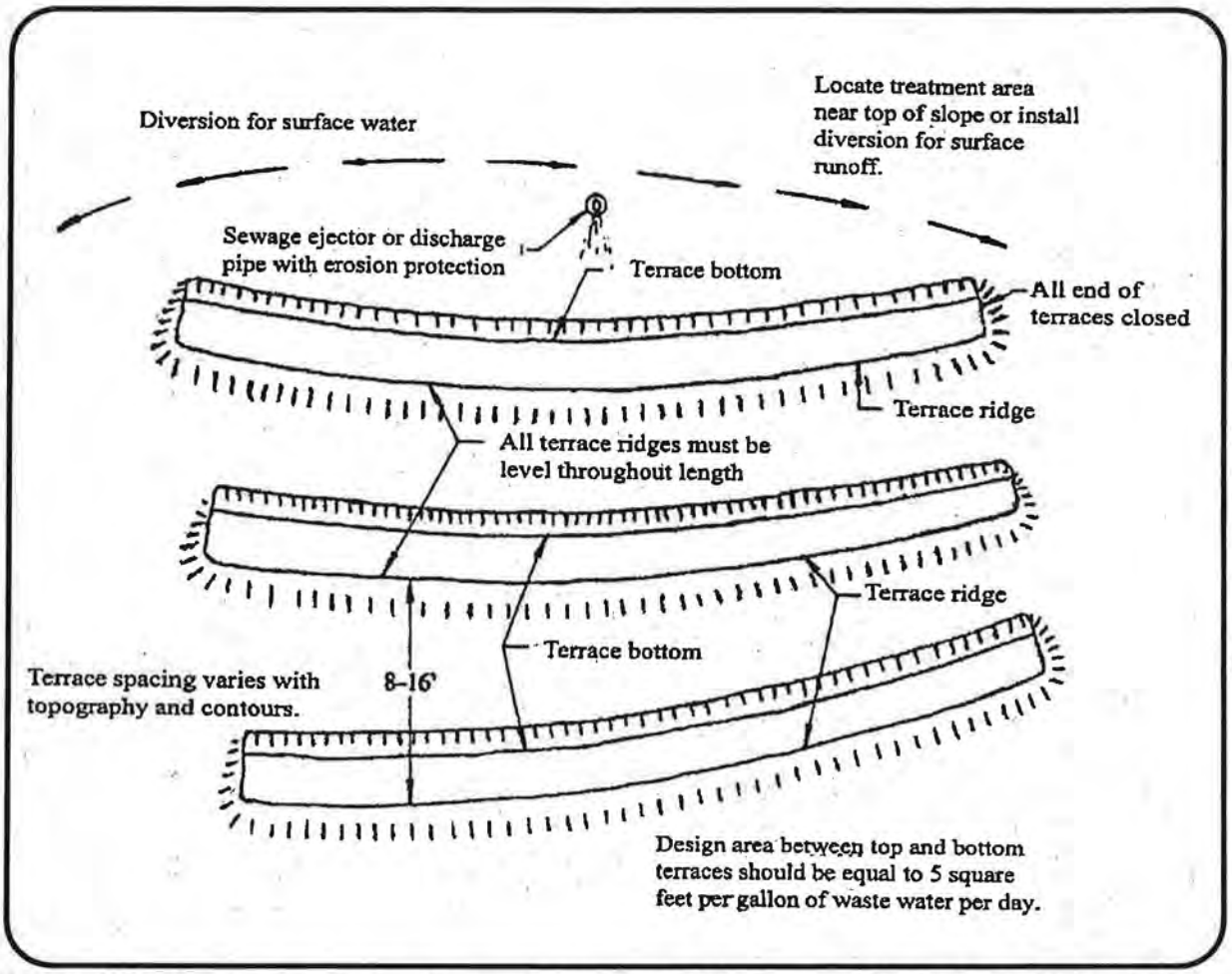

***Figure 4*: Contour terraces.** *Source: Treatment and disposal of Milkhouse and Milking Parlor Wastes, D.W. Bates and R.E. Machmeier, University of Minnesota Agricultural Extension Service, M-159, 1977.*

Worksheet 10

Milking Center Wash Water Treatment: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk rankings for milking center wash water treatment practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
NO DISCHARGE METHODS (Addressed in Section 1)					
All wash water to storage and later applied to fields*	Wash water delivered directly to liquid manure storage. No discharge expected.	———	———	Wash water delivered to leaking or frequently overflowing manure storage.	____
TREATMENT OF MILKING CENTER WASH WATER BEFORE DISPOSAL (Addressed in Section 2)					
Milking cleanup practices	First pipeline rinse captured and added to barn manure. Waste milk never poured down drain. Manure and excess feed removed from parlor before wash-down.	Waste milk poured down drain 10 percent of the time. Manure and excess feed usually removed before wash-down.	Waste milk poured down drain 50 percent of the time. Manure and excess feed often washed down drain.	All waste milk poured down drain emptying into ditch. Manure and excess feed frequently washed down drain emptying into ditch.	____
Storage/settling tank liner	Concrete or plastic lined.	Clay lined.	Cracked or porous liner.	No liner to prevent seepage.	____
Settling tank cleanout	Tank cleaned as needed or every month.	Tank cleaned every 3-4 months.	Annual cleaning.	Tank never cleaned.	____
Liquid storage period following settling	9-12 months.	1 week to 9 months.	Less than 1 week.	No storage/settling. Wash water discharged directly to soil as generated.	____

**If using this practice, do not complete the rest of this worksheet.*

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LAND APPLICATION SITE					
Distance from drinking water well	More than 250 feet downslope from well.	More than 250 feet upslope from well.	Less than 250 feet downslope from well.	Less than 250 feet upslope from well.	____
DISCHARGE METHODS (Addressed in Section 3)					
Field application	Applied to growing crops. Nutrient and water needs of crop not exceeded. Vegetation removed regularly.	Applied to uncropped fields. Nutrient and water needs of vegetation not exceeded. Vegetation removed occasionally.	Applied to cropped or uncropped fields. Plant nutrient needs not exceeded. Plant water needs exceeded occasionally. Vegetation may or may not be removed.	Applied consistently to same area. Rates exceed vegetation nutrient and water needs. Vegetation rarely removed.	____
or					
Slow surface infiltration	Combined with high-level pretreatment. Medium or fine-textured soil (silt loam, loam, clayloams, clay) more than 10 feet to water table or bedrock. Extended rest period between loadings. Vegetation removed.	Combined with high-level pretreatment. Medium or fine-textured soil (silt loam, loam, clayloams, clay) more than three feet to water table or bedrock. Extended rest period between loadings. Vegetation removed.	Some pretreatment. Medium or fine-textured soil (silt loam, loam, clay loams, clay) more than two to three feet over bedrock or high water table. Vegetation not removed.	No pretreatment. Less than two feet of medium or fine-textured soil (silt loam, loam, clay loams, clay) above bedrock or high water table. Vegetation not removed.	____

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Milking Center Wash Water Treatment Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
All wash water to manure storage and later applied to fields				
Milking clean-up practices				
Storage/settling tank liner				
Settling tank clean-out				
Liquid storage period				
Distance from drinking water well				
Field application				
Slow surface infiltration				

Step 2: Look over your rankings for individual activities.

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Potential ground-water contamination from your milking center wash water

Your local public health district, Soil Conservation District (SCD), or Natural Resources Conservation Service (NRCS) office.

Sources of financial assistance

Your county Farm Service Agency (FSA).

Review of construction plans

To be sure that sanitation and water quality regulations are being met, contact University of Idaho Cooperation Extension System (CES) and/or your local NRCS office.

Securing a permit

Before committing to a new facility, contact the Division of Environmental Quality regional office for your area:

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

Contact your County Planning and Zoning Commision for any local regulations pertaining to securing new permits.

Designing wash water treatment systems

Your county SCD, NRCS, or local CES office.

What to read about...

Your county SCD, NRCS, or local CES office.

Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.

Ground-water contamination, protection, and testing

- *CAFO Waste Management Guidlelines (DEQ)*
- *Managing Livestock Manure to Protect Groundwater EB1717 (1)*
- *Keys to Dairy Manure Management for Water Quality EB1658 (1)*
- *Livestock Manure Lagoons Protect Water Quality EB1642 (1)*
- *Liquid Manure Injection EB1004 (1)*
- *How Fertilizers and Plant Nutrients Affect Groundwater Quality EB1722 (1)*
- *Water Quality for Domestic Use: Resource Handbook (1)*

Design criteria and general information

• *Agricultural Waste Management Field Handbook. 1992. (3).* A recent, comprehensive guide addressing animal management and resource protection.

• *Dairy Housing and Equipment Handbook. Midwest Plan Service. MWPS-7.(2).* Presents dairy facility and equipment planning and design. Discusses milking herd facilities, milking centers, manure management, housing needs, and basic farmstead planning principles.

• *Livestock Waste Facilities Handbook. Midwest Plan Service. MWPS-18. (2).* Emphasizes planning and design of livestock waste facilities and equipment. Reports agricultural waste data for manure, bedding, feedlot runoff, and milking center wash water.

Land application of animal waste

• *How to Calculate Manure Application Rates in the Pacific Northwest PNW0239 (1)*
• *Livestock Waste Facilities Handbook. 1985. Midwest Plan Service. (2).* Includes information about animal waste characteristics, collection and transport to storage, open lot waste handling, land application techniques, and waste use. Worksheet helps producers determine manure application rates for their system.
• *Guidelines for Land-Disposal of Feedlot Lagoon Water. C-485. (1)*

Publications available from...

• Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
• Your county Cooperative Extension System office or the Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.
• Your local Natural Resources Conservation Service (NRCS) office.

NOTES

The Homestead Assessment System is a cooperative project developed, coordinated, and supported by the following agencies and organizations:

Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination from

Lawn and Garden Management

Fact/Worksheet 11

Keeping Idaho's Water Clean

Why should I be concerned?

Pesticides, fertilizers, and water play an important role in maintaining a successful lawn and garden. Pesticides control undesirable weeds, insects, diseases, and rodents; fertilizers increase the fertility of the soil to enhance the growth of plants; and of course water, is essential for the very life of the plants a homeowner is growing. However, if pesticides, fertilizers, and water are not used properly, there is potential that ground water and thus drinking water will be contaminated. Surface water can also be impacted if the chemicals are carried in runoff.

When pesticides are found in water supplies, they are rarely in high enough concentrations to cause immediate health effects. Rather, the concern is through their potential to cause problems from prolonged exposure.

Nitrate in ground water can be a result of fertilizer application. Infants younger than six months are believed to be susceptible to nitrate poisoning as their digestive system is not developed to kill the bacteria that converts nitrate into toxic nitrate. Nitrate interferes with the ability of blood to carry oxygen, so the baby may show signs of suffocation. The drinking water standard is 10 ppm (NO_3-N). Nitrate poisoning may also occur in ruminant animals such as cattle and sheep.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my drinking water?

This worksheet will help you protect your drinking water by:

- Helping you determine which of your lawn and garden practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk ratings.

Information derived from Home*A*Syst worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. It is not the intent of this educational program to keep records of individual results.

Glossary

Lawn and Garden Management

These terms may help you make more accurate assessments when completing Fact/Worksheet 11. They may also help clarify some of the terms used.

Available water capacity: The capacity of the soil to store water available for plant use, usually expressed in linear depths of water per unit depth of soil. Commonly defined as the difference between the percentage of soil water at field capacity and the percentage at wilting point.

Fertilizer: A substance that is added to soil to increase the nutrient content of a soil.

Field capacity: The percentage of water remaining in a soil two or three days after having been saturated and after free drainage has practically ceased.

Herbicides: A pesticide that is used to manage weeds.

Insecticides: A pesticide that is used to manage insects.

Irrigation water management: The use and management of irrigation water where the quantities of water used for each irrigation is determined by available water capacity of the soil and the need for the crop, and where the water is applied at a rate and in such a manner that the crop can use it efficiently and significant erosion does not occur.

Leachability: The ease with which a chemical is dissolved by water. The more readily a chemical is dissolved by water, the more readily it can be move in the subsurface and contaminate ground water.

Leaching: The removal from the soil in solution of the more soluble materials by percolating water.

Nematocides: A pesticide that is used to manage nematodes.

Organic fertilizer: Fertilizers that are derived from natural sources, such as oceans, rocks, animal by-products, or plants and release their nutrients over a long period of time (6 months to 5 years).

Pesticides: A substance used to manage plant disease, insects, weeds, or rodents.

Rodenticides: A pesticide that is used to manage rodents.

Synthetic fertilizer: Fertilizers that are manufactured and release their nutrients over a very short period of time.

Wilting point: The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower plants) wilt and fail to recover their turgidity when placed in a dark, humid atmosphere.

Improving Lawn and Garden Management

Keeping Idaho's Water Clean

Idaho homeowners are rightly proud of their beautiful lawns and gardens, however, large quantities of fertilizers, pesticides, and water are often applied to obtain these results. Overuse or misapplication of chemicals can have a detrimental impact on ground water that supplies your well. Recent surveys in Idaho have found trace amounts of nitrates and pesticides in drinking water. Over watering can compound water quality problem by causing the chemicals to leach into the ground water or runoff into the surface water.

The material in this fact sheet provides information for the homeowner on management practices for lawns and gardens to reduce the potential for surface and ground-water contamination. The accompanying worksheet will allow you to assess the impact of your current management practices on the quality of your drinking water.

Pesticide concerns for lawns and gardens

Why should homeowners be concerned about pesticide use on their lawns and gardens?

Compared to a farmers field, some homeowners use a larger quantity of pesticides on their lawns and gardens. Pesticide over use or misapplication may cause the following:

- Harm or kill beneficial insect and earthworms associated with your lawn or garden;
- Harm wildlife and pets that come in contact with your lawn or garden;
- Result in chemical runoff during rainfall or irrigation into streams, rivers, lakes, and storm water sewers which may contaminate the ground water;
- Leach through the soil directly into ground water which is used for drinking water;
- Accumulate in the soil and become toxic to the plants you are growing; and
- Create pest resistance to the applied chemicals so that they will be very difficult to control in the future.

Fertilizer concerns for lawns and gardens

Why should homeowners be concerned about fertilizer use on lawns and gardens?

Some homeowners use a larger quantity of fertilizer on their lawns and gardens than is really needed. Fertilizer over use or misapplication may cause:

- Contaminate surfact water with nitrates through surface runoff or storm water sewers.
- Contaminate drinking water from ground water wells with nitrates, which is hazardous especially to pregnant women, infants, and small children.
- Contaminate surface water with nitrates through surface runoff or storm water sewers.

- Cause diseases, such as necrotic ring spot in lawns, if you are also watering too heavily or at the wrong time.

- Make some weeds more competitive with the plants you are trying to grow.

1. Lawns

Your lawn is something you should be proud of. It is an attractive part of your landscape. In fact, a well maintained lawn adds value to your property and helps to tie together your home and other landscape plants.

A healthy good looking lawn actually improves your living environment. On a hot day, your lawn reduces the glare of the sun, keeps surrounding areas cooler, and will attract birds and other wildlife. On windy days, your lawn protects the soil on your property from erosion.

Some Idaho homeowners intensively manage their lawns and gardens by using large quantities of chemicals. Pesticides, fertilizers, and water, when used incorrectly may adversely impact the quality of your drinking water. To protect your water quality and the environment, you should use best management practices (BMPs), which are defined as strategies that eliminate or minimize pollution. BMPs are designed to be compatible with good, sound lawn management but can also protect the quality of water from your drinking water well.

Pest management for lawns

Many pests attack lawns. These pests fall under four broad categories: weeds, insects, diseases, and other pests.

Weeds: Weeds simply are plants growing in the wrong place. In the case of your lawn, a weed is any plant that is not the variety of grass that was originally seeded to produce your lawn. There are over 30 weeds common to lawns in the Pacific Northwest. Most of these weeds can be easily eliminated from your lawn by using management options that discourage the competition from weeds. These options include mowing to the proper height, not over fertilizing or watering. Chemicals are also an option and the ones that kill weeds are called herbicides.

Insects: Several dozen different insects live in your lawn at any one time. Most of these insects are harmless and in fact, many insects are actually beneficial. These beneficial insects prey on insect pests that harm your lawn. Chemicals applied to lawns to kill insects are called insecticides.

Diseases: Lawns are susceptible to several different diseases. Many of the diseases that attack lawns are caused by improper management by the homowner. Some potential management problems include improper watering and fertilization, lack of thatch removal, and choosing the wrong grass type for the climate. Chemicals that are applied to lawns to control disease problems are usually called fungicides.

Other pests: Several categories of non-insect pests attack lawns. These include rodents (moles and gophers), nematodes, snails, slugs, and ants. Chemicals used to kill rodents are called rodenticides. Chemicals used to kill nematodes are called nematocides.

Pest management BMPs that should be implemented for lawns include:

- Know what is in your lawn. Identify weeds, insects, pests, disease problems, and your grass type (bluegrass, fescue, etc.) so you can choose the proper solution to your problem.

- Use the least toxic solution to your problem. For example, consider hand pulling weeds, change water management practices instead of using fungicides to control diseases, and live with a low level of plant damage.

- Use pesticides carefully. Be sure to match the pesticides with the problem, follow label directions, use the correct application rates, buy only what you need, and if possible spot treat rather than treat the entire lawn.

- Store and dispose of pesticides properly. Buy pesticides in small quantities, store it in a secured area away from your water well and dispose of the material safely through your locally organized household hazardous waste collection. The Pesticide Disposal Program, Idaho Department of Agriculture, (208) 332-8500, targets pesticide users at agriculture rater, but in some cases may be able to provide assistance for rural home owners.

- Use water wisely on lawns. Over-watering may cause pesticides to leach and contaminate the ground water you use for drinking water.

Fertilizer management for lawns

Lawns in Idaho generally need additions of only four nutrients: nitrogen (N), phosphorus (P), potassium (K), and sulfur (S). However, if your soil pH exceeds 6.8, your lawn may also require additions of iron (Fe). Most soils in Idaho have adequate amounts of trace elements, such as copper, manganese, nickel, and zinc to meet lawn needs. BMPs for fertilizer management should include the following:

- Test your soil. The results of the test will help you determine what kind and how much fertilizer you need to apply to keep your lawn healthy. Soil testing kits are available at most lawn and garden shops for a small cost or assistance may be provided by your county Cooperative Extension System agent.

- Use fertilizers that slowly release the nutrients. By using slow release fertilizers, the lawn is fed slowly so there is no excess fertilizer to leach to the ground water that you use for drinking water. Also, using slow release fertilizer eliminates the risk of burning the grass.

Irrigation water management for lawns

Water is a precious, limited resource and we need to not only watch how we water lawns to prevent the leaching of chemicals into the ground water, but we also need to be sure we do not waste it by over watering. Both your lawn and water bill can benefit by using the following BMPs for lawn watering:

- Apply water only when it needs it. The lawn needs water when it begins to wilt from dryness (color dulls and footprints stay compressed for more than a few seconds) or about a couple times a week. When you do water, water slowly and apply about an inch of water, then let the lawn dry out before watering again. Be sure to water during times when evaporation is lowest, for example, in the early morning.

- Avoid over watering. Avoid this at all times, but especially after applying fertilizers and pesticides. Too much water will push the fertilizer past the grass root zone into ground water or cause the applied pesticide to runoff into surface water or leach into ground water.

2. Gardens

Your garden is a complex ecosystem of plants, animals, insects, birds, fungi, worms, and microorganisms such as bacteria. All ecosystems have three basic interacting categories of organisms:

- Producers, which are green plants that convert sunlight, carbon dioxide, and water into energy for plant growth.
- Consumers, which are organisms that feed on live plant or animal material.
- Decomposers, which use dead plant and animal material for energy.

A healthy garden ecosystem will have a balance between producers, consumers, and decomposers. If there is an imbalance, symptoms such as plant disease or an increase of damaging pests may result.

An imbalance in the ecosystem can be caused by improper applications of pesticides, fertilizers, and water or by removing organic matter, such as leaves, from the garden. By using gardening BMPs, you will reduce the potential for gardening problems and thus the need for chemical controls. By reducing the use of chemicals, the risk of contaminating your drinking water is also reduced.

Pest management for gardens

It is best to try to not use pesticides as both beneficial insects and pests may be killed. The following pest management BMPs will help keep your garden ecosystem healthy.

- Create a garden with diversity. Plant a combination of different types of plants to create a balanced ecosystem and in general, rotate plants each year to outsmart potential pests and minimize the threat of soil borne diseases.
- Maximize conditions for healthy plant growth. Choose plants that are suited for your climate and are resistant to diseases in the area. Group plants according to water and light requirements and space them to allow ample root and top growth at maturity.
- Protect and use beneficial insects. Develop garden habitats to ensure a healthy environment for beneficial insects. Also, learn to recognize the eggs and larvae of beneficial insects so as to not harm them.
- Use the least toxic solution for your problems. Some low toxic methods to solve problems include biological controls, insect traps, or mechanical means to remove pests. Also, learn to live with a low level of plant damage.
- If you do use herbicides or pesticides, use them carefully. Identify the insect and weed pests and select the appropriate chemical. Also, buy only what you need and be sure to follow label directions.
- Store and dispose of herbicides and pesticides properly. Store any extra in a secured area, and if you need to dispose of these chemicals, take it to your locally organized household hazardous waste collection. The Pesticide Disposal Program, Idaho Department of Agriculture, (208) 332-8500, targets pesticide users at agricultural rates, but in some cases may be able to provide assistance for rural homeowners.

Fertilizer management for gardens

Fertilizer should be added only in the amounts needed, at the appropriate time, and in a form that makes the nutrients available to plants. Nutrient management BMPs to implement in your garden include:

- Test your soil. Test your soil for nitrogen (N), phosphorus (P), potassium (K), sulfur (S), pH, and organic matter. Soil samples should be taken to a depth of 12 inches.

- Build a healthy soil. Add organic matter, such as compost to enhance the structure, aeration, and nutrient and water holding capacity of the soil. Organic matter can also be added by growing cover crops. Also, try to supply needed nutrients using organic fertilizers, such as composted manure, cottonseed meal, bone meal, blood meal, and greensand. Most gardening shops have these types of fertilizers. If not, you can order from gardening retailers that specialize in providing organic fertilizers and pesticides.

- Apply fertilizers properly. Based on your soil test and plant needs, apply the proper rate of nutrients and apply it at the correct growth stage of the plant. Overfeeding plants can be as detrimental as underfeeding, but this risk can be reduced if organic fertilizers are used, because the nutrients are released slowly. Synthetic fertilizers are also useful, as they can provide readily needed nutrients. Be sure not to over apply.

Irrigation water management for gardens

Excess water use may result in nutrients leaching below the root zones into the ground water that is used for drinking water. Excess watering can also leach pesticides into ground water.
Some water management BMPs are:

- Reduce the need for watering by mulching. Mulches not only show the evaporation of water from the soil surface but also can improve a soil's water holding capacity, keep the soil cooler on hot summer days, reduce weed growth, and help prevent soil erosion. Examples of organic mulches include grass clippings, leaves, and straw. Inorganic mulches may also be used and examples are permeable sheeting and/or rock. Keep in mind that rocks can form undesirable heat sinks.

- Reduce the need for watering by improving soil structure. Each year be sure to add organic matter such as compost, grass clippings, tilled in cover crops, and other dead plant materials.

- Irrigate only when the plants need water. Check whether the soil is dry several inches below the surface. If it is dry, then water, but water slow enough so that it soaks into the root zone and does not run off the soil surface. The depth of the root zone depends on the plant, but in general this is 6 to 18 inches deep. If possible, use a drip irrigation system to conserve water.

3. Summary

To help protect the quality of your drinking water for your family and future generations, it is important to implement BMPs for pest, fertilizer, and water management for your lawn and garden.

Worksheet 11

Lawn and Garden Management: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15-30 minutes to complete the worksheet and summarize your risk rankings for well management practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
WELL LOCATION *(Addressed in Section 1 and 2)*					
Location of well in relation to area of application	Most of area is down gradient from well. Surface water is diverted from well.	Area is at grade or down gradient from well. Surface water is diverted from well.	Area is at grade or up gradient from well. Surface water runoff may reach well.	Area is up gradient from well. Surface water runoff reaches well.	____
Use of chemicals to control pests	No application of chemicals. Use non-toxic solutions to problems.	Use mostly non-toxic solutions to problems. Some careful spot use of chemicals.	Limited use of chemicals, but more than spot use.	Use of chemicals on large areas.	____
Relative leachability of pesticide	Low	Low-Medium	Medium-High	High	____
Storage of pesticides	Storage of pesticides in a secured area away from the well.	____	____	Storage of pesticides in close vicinity to the well.	____
Disposal of pesticides	Disposal through a local household hazardous waste collection or other appropiate means.	____	____	Disposal on property in close vicinity to the well.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER MANAGEMENT *(Addressed in Section 1 and 2)*					
Location of application	Most of area is down gradient from well. Surface water is diverted from well.	Area is at grade or down gradient from well. Surface water is diverted from well.	Area is at grade or up gradient from well. Surface water runoff may reach well.	Area is up gradient from welll. Surface water runoff reaches well.	____
Solubilty of fertilizer	Low solubility: Use of organic fertilizer.	Low-Med solubility. Use of predominately synthetic fertilizers, but some organic fertilizers.	Med-High solubility. Use of predominately synthetic fertilizers, but some organic fertilizers.	High solubility. Use of synthetic fertilizers.	____
Amount of fertilizer application	Application rates based on soil tests. Recommended amount calculated, measured, and applied.	Application rate based on soil tests. Recommended amount estimated, measured, and applied.	No soil tests. Plant needs estimated, then measured and applied.	No soil tests. Application of fertilizers at unknown rate.	____
Timing of fertilizer application	Calculated total plant needs. Made several applications during the growing season, according to plant requirements.	Calculated total plant needs. Entire amount applied in one single application during the growing season.	Plant needs not determined, and entire amount applied in one single application during the growing season.	Plant needs not determined; fertilizer applied during the non-growing season.	____
Storage of fertilizers	Storage of fertilizers in a secured area away from the well.	____	____	Storage of fertilizers in a non-secured area in close proximity to the well.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
IRRIGATION WATER MANAGEMENT *(Addressed in Sections 1 and 2)*					
Amount of water application	Measured application based on the plants' consumption use requirements (in./day) and the soils' available water capacity.	Measured applications based on filling the soil to field capacity within the plants' effective root zone.	Non-measured applications based on estimates of the plants' needs.	Non-measured heavy applications based on neither the plants' needs or the soils' moisture levels.	_____
Timing of water application	Application of water based on the plants' needs and soil moisture levels.	Application of water based on plants' needs, but prior to the plants' wilting point.	Application of water based on convenience **or** when irrigation water is available.	Heavy application of water soon after use of pesticides and fertilizers.	_____

*Use the USDA Natural Resources Conservation Service (NRCS) Information.

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Lawn and Garden Management Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Location of well in relation to area of pesticide application				
Use of chemicals to control pests				
Relative leachability of pesticide*				
Storage of pesticides				
Disposal of pesticides				
Location of application				
Solubility of fertilizer*				
Amount of fertilizer application				
Timing of fertilizer application				
Storage of fertilizers				
Amount of water application				
Timing of water application				

* These practices in themselves do not create a situation that needs immediate attention. However, if combined with a high risk rate of application or timing of watering, then the situation will require immediate attention.

Step 2: Look over you rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances.

Low to Moderate Risk Practices (3) Provide reasonable ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns, you can take care of right away; others could be major or costly projects requiring planning and prioritizing before you take action. The long term goal of the Home*A*Syst project is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't done so already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References

Who to call about...

Soil testing and interpretation:

- Cooperative Extension System serving your county
- Local Soil Conservation Districts
- Local gardening centers

Pesticide information:

- Cooperative Extension System serving your county
- Idaho Department of Agriculture, Agriculture Technology, (208) 332-8500
- Local Soil Conservation Districts
- Local gardening centers
- National Pesticide Telecommunications Network, (800) 858-7378

Fertilizer information:

- Cooperative Extension System serving your county
- Idaho Department of Agriculture, Agriculture Technology, (208) 332-8500
- Local Soil Conservation Districts
- Local gardening centers

Least toxic methods for lawn and garden problems:

- Cooperative Extension System serving your county
- Bio-Integral Resource Center, P.O. Box 7414, Berkeley, CA 94707
- Libraries, bookstores, garden centers

What to read about...

- *EPA Citizens Guide to Pesticides*, EPA Office of Pesticide Programs, Field Operations Division, H7506C, 401 M Street, SW Washington, D.C. 20460
- *Healthy Lawn, Healthy Environment*, U.S. Environmental Protection Agency, June 1992.
- *Nitrate and Groundwater*, Idaho Cooperative Extension System, Current Information Series #872.
- *Pesticide Handling Practices to Protect Groundwater*, Idaho Cooperative Extension System, Current Information Series #861.
- *Pesticides and Their Movement in Soil and Water*, Idaho Cooperative Extension System, Current Information Series #865.
- *Pests of the Garden and Small Farm, A Growers Guide to Using Less Pesticides*, Division of Agriculture and Natural Resources, University of California, 6701San Pablo Avenue, Oakland, California 94608-1239, (413)642-2431.

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Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
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Assessing and reducing the risk of ground-water contamination from

Pasture and Riparian Management

(small ranchette-type operation)

Worksheet 12

Keeping Idaho's Water Clean

Why should I be concerned?

Pastures and riparian areas are critical components of watersheds. Their management can have a tremendous effect on the quality of water and habitat in watersheds. Sediment, bacteria, nutrients, and temperature are the water quality parameters that are influenced by pasture and riparian area management. Improper animal grazing management practices can lead to poor water quality and habitat in streams and lakes.

Excess sediment can cover spawning and resident fish sanctuaries making them unusable. It carries nutrients which can lead to the eutrophication of lakes and will also eventually fill lake systems shortening their useful life.

Excess bacteria renders streams and lakes unfit for recreational uses such as swimming, water skiing, and wading. Nutrients can lead to excessive aquatic plant growth in streams and lakes, as well as excessive algae production and accelerated eutrophication in lakes. High temperatures are not desirable for cold water species of fish such as trout. Not only do they prefer cool water, but oxygen levels may be decreased as a result of increased temperatures.

The goal of Home*A*Syst is to help you protect the environment and your drinking water.

How will these materials help me to protect my riparian areas?

- It will take you step-by-step through your animal pasture and riparian management practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your animal pasture and riparian management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which ones might require modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Glossary

Pasture and Riparian Management

These terms may help you make more accurate assessments when completing Fact/Worksheet 12. They may also help clarify some of the terms used.

Available water capacity: The capacity of the soil to store water available for plant use, usually expressed in linear depths of water per unit depth of soil. Commonly defined as the difference between the percentage of soil water at field capacity and the percentage at wilting point.

Eutrophication: A means of aging of lakes whereby aquatic plants are abundant and waters are deficient in oxygen. The process is usually accelerated by enrichment of waters with surface runoff containing nitrogen and phosphorus.

Evaporation: The act or process by which a liquid is converted or changed into a vapor.

Evapotranspiration: Loss of water from the soil both by evaporation and by transpiration from the plants in the soil.

Field capacity: The percentage of water remaining in a soil two or three days after having been saturated and after free drainage has practically ceased.

Ground-water recharge: The addition of water to the saturated zone in a ground-water system.

Infiltration rate: A soil characteristic determining or describing the maximim rate at which water can enter soil under specified conditions, including the presence of an excess of water. Soils having clayey surface textures would have a slow rate whereas those having sandy surface textures would have a high infiltration rate.

Irrigation water management: The use and management of irrigation water where the quantity of water used for each irrigation is determined by the available water capacity of the soil and need for the crop, and where the water is applied at a rate and in such a manner that the crop can use it efficiently and significant erosion does not occur.

Percolation (soil water): The downward movement of water through the soil. Water would move slowly through clayey soils and quickly through sandy soils.

Riparian area: Areas adjacent to creeks, streams, and rivers where vegetation is strongly influenced by the presence of water.

Transpiration: The act or process whereby plants and animals give off vapor, containing waste products, through the pores of the skin or the stomata of plant tissue.

Wilting point: The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower plants) wilt and fail to recover their turgidity when placed in a dark humid atmosphere.

Improving Pasture and Riparian Management

Keeping Idaho's Water Clean

Over the past several years, there has been a migration from city residential single family living to homes on small acreages. This fact sheet will address conservation and pollution prevention measures which can be incorporated to protect pastures and riparian areas up to twenty acres in size. The need for this type of of information has been clearly demonstrated in the Cascade Reservoir watershed improvement project. Owners of these small ranchettes are concerned about what they can do to help with the restoration of the watershed. Improper grazing management of pasture and riparian areas by small ranchettes can lead to pollutants such as sediment, nutrients, and bacteria entering streams. Individually, their contribution may seem small, but as the numbers of small ranchettes increase, the potential for pollutant input on a watershed scale becomes more real. This fact sheet will provide the information these landowners should consider to become a part of the solution to improve water quality.

This fact sheet is intended for use on small ranchette type operations throughout the State of Idaho. An example of the target lies within Valley County, where 65 percent of the counties' 7,000 housing units are outside city limits. An estimated 30 percent, or approximately 1, 365 of these units can be characterized as ranchette dwellings (1994 Valley County Planning & Zoning Department and Valley Soil & Water Conservation District estimates).

1. Animal Pastures

Pastures in good condition provide adequate protection from erosion by wind or water. Proper grazing systems help to prevent erosion and sediment delivery from pasturelands. Soil compaction and increases in water runoff can occur when pastures are grazed when wet. This can occur on pasturelands used as winter and spring feeding areas, on pastures grazed in early spring while soils are still wet, and on pastures grazed during or too soon after irrigation. Overgrazing can leave pastures vulnerable to erosion by wind, water, or irrigation and lead to excessive nutrient leaching or washing.

For a successful grazing program, the following management tips should be considered:

- Eliminate continuous season-long grazing; allow long rest periods or use a high-intensity, short-duration grazing system to rejuvenate poor condition pasture.
- Subdivide large pastures into smaller ones, and develop and maintain a pasture-rotation system.
- Corral livestock and feed them hay until your pasture grasses are 6" to 8" high. Move livestock when 50% of the grass plant has been eaten (3" to 4" height remains). Do not regraze until grasses are at least 6" high (will take one to three months).
- During winter months, continue your rotation to distribute manure and feed wastes evenly across your pastures or hold animals in a corral.
- Horses do not need 24-hour access to feed or forage as nutritional needs can be met with only a few hours of grazing on good pasture each day. Corral animals for a period each day to prevent overgrazing of plants and extend usage of available forage.
- Provide a water source for each pasture.
- Irrigate each pasture (if irrigated) immediately after grazing to get plants growing again. Do not graze on wet soils.

2. Riparian areas

What is a riparian area?

Riparian areas are those areas adjacent to creeks, streams, and rivers where vegetation is strongly influenced by the presence of water. By influencing the timing and quality of water produced, the condition of riparian areas can have significant economic and environmental consequences. Riparian vegetation filters out sediment which builds streambanks, forms productive wet meadows and flood-plains, and reduces sedimentation of reservoirs. Riparian areas in good condition slowly release water to stream channels, thus improving seasonal water quantity and quality. They also stabilize the water table as well as water to be recharged, and assist in the beneficial recycling process of accumulated nutrients.

How does grazing relate to riparian areas?

Management of animal grazing on riparian areas for small plots of land should follow the same basic strategy as that for larger plots of public or private land. Improper animal grazing can affect the amount, timing, and quality of water in riparian areas. Improper animal grazing effects on riparian areas include loss or reduction of streamside vegetation and trampling of streambanks and channels. Channel stability is reduced and becomes more susceptible to erosion by high flows. Stream down-cutting or channelization of riparian areas will result in additional erosion and lowering of the water table. Streambank compaction can also occur and contribute to poor plant root development and decreasing the soil's infiltration rate. Improper grazing can eliminate woody vegetation which would result in decreased shade and a potential increase in stream temperatures. Streams will become wide and shallow, resulting in elevated water temperatures and will have a negative effect on cold water insects and fish.

Degraded Riparian Areas	***Healthy Riparian Areas***
• Little vegetation to protect and stabilize streambanks and shade stream	• Diverse vegetation and root systems protect and stabilize streambanks; stream shaded
• Lowered water table and saturated zone, reduced subsurface water storage	• Elevated water table and saturated zone, increased subsurface water storage
• Reduction or elimination of summer streamflows	• Increased summer streamflows
• Warmer water in summer and increased icing in winter	• Cooler water in summer, reduced icing in winter
• Poor habitat for fish and other aquatic organisms	• Good habitat for fish and other aquatic organisms
• Poor habitat for wildlife	• Good habitat for wildlife
• Reduced quantity and quality of livestock forage	• Increased quantity and quality of livestock forage
	• Increased potential for nutrient recycling

3. Potential ground-water impacts

Poor grazing management practices often lead to slower soil infiltration rates. Decreased plant cover leaves more soil exposed to raindrop impact and soil compaction, further reducing infiltration rates. A slower infiltration rate means that more water will run off and less water will be available for plant growth, subsurface percolation, and ground-water recharge.

The potential impact on the quantity and quality of deep ground-water aquifers is low. However, grazing can impact the quality, amount, and timing of shallow ground water. In many cases, the flow of perennial and intermittent springs and streams is sustained by shallow ground-water flow. Again, poor grazing management practices can alter the amount of shallow ground-water flow and impact water quality. Decreased soil infiltration will cause increased overland and ground-water flow and can also cause a shift in plant species and increased evapotranspiration.

4. Potential surface water impacts

Most research indicates that impacts to surface water from poor grazing management practices can occur in the form of increased bacteria and nutrient concentrations and increased sediment production in the downstream portion of the watershed. It appears that coliform bacteria in streams are a function of animal density and their direct access to streams. When high bacteria levels occur, they have been found to return to acceptable levels within several stream miles.

Of the nutrients that could impact streams, nitrogen and phosphorus are of most concern. Phosphorus binds to soil organic and mineral particles and is a potential polluntant any time soil erosion rates are high. On pastures receiving commercial fertilizer, there is the potential for nutrient loss to streams, especially in areas with poor irrigation water management, poor grazing management, or soils that have a high leaching potential.

5. Riparian grazing potential solutions

Best: Use fencing to exclude livestock from the riparian area. Livestock exclusion allows riparian plants the greatest opportunity for recovery in the shortest period of time. Significant improvement is often seen in only two to three growing seasons. Even a small gap in a fence can give livestock access to water.

Good: Use fencing to allow controlled grazing of the riparian area. Avoid grazing the riparian area until streambanks are stable and well vegetated, then graze only in the late spring. Avoid early spring grazing because streambanks are saturated and vulnerable to trampling. Avoid summer and fall grazing because this is when livestock tend to overgraze shrubs, especially willows. In just a few days, livestock can remove an entire year's shrub growth. Avoid grazing riparian plants shorter than three inches.

Best management practices

Best Management Practices (BMP's) are practices or combinations of practices found to be the most effective and practicable means of preventing or reducing the amount of pollution generated by nonpoint sources. For a BMP to be practicable, it must be: technically feasible, economically feasible, and socially acceptable.

Best Management Practices that could be useful to the ranchette type operation for grazing of both pasture and riparian areas are:

- **Fencing.** Enclosing or dividing an area of land with suitable permanent structures that act as a barrier to animals, wildlife, or people. Rotational grazing can be used with properly fenced pastures. Temporary fencing can enhance grazing system.

- **Livestock exclusion.** Excluding animals from an area not intended for grazing. Fencing is an excellant way to exclude animals from riparian areas. The width of area fenced should be carefully planned.

- **Nutrient management.** Managing the amount, form, placement, and timing of applications of plant nutrients. Performed properly, nutrient inputs to streams from fertilizer applications can be substantially reduced.

- **Pasture management.** Proper treatment and use of pasture. Planning the use and fertilization of pastures helps focus other practices towards water quality goals.

- **Planned grazing system.** A practice where two or more grazing units are alternately grazed. This could be useful where separation of pastures will continue to improve forage.

- **Pond.** Embankment or excavated ponds that are used to water animals. Small constructed ponds are valuable as sources of water when stream access is prevented to provide riparian area protection.

- **Proper grazing use.** Grazing at an intensity that will maintain enough cover to protect soil and maintain or improve vegetation quality and quantity. This can be used in conjunction with separation of pastures.

- **Water development.** Improving springs and seeps by excavating, cleaning, capping, or providing collection and storage facilities. Also includes wells and pipelines in order to place water where desired. When springs are located on the property, they can become an excellent source of stock water. This can be part of a riparian protection plan.

- **Channel vegetation.** Establishing and maintaining adequate plants on streambanks, berms, spoil, and associated areas. This is an excellent way to improve riparian condition. It should be used with other measures, such as, animal exclusion or rest.

- **Critical area planting.** Planting vegetation, such as, trees, shrubs, vines, and grasses or legumes on highly erodible or critically eroding areas. This practice is an excellent way to reduce sediment runoff from any problem area. It should be used with other measures, such as, animal exclusion or rest.

- **Ephermeral watercourse planting.** Using adapted plant species and double seeding techniques to reduce the formation of ephermeral gullies. When used in combination with small rock structures, this can be very effective at reducing erosion.

- **Fish stream improvement.** Improving a stream to create new fish habitat or enhance existing habitat (will require a stream alteration permit from the Corps of Engineers). When used in conjunction with other riparian area protection methods, a ranchette can have both grazing and a natural environment with an improved instream fishery.

- **Heavy use area protection.** Protecting heavily used areas by establishing plant cover, surfacing, or structures. This is an excellent way to prevent erosion from high traffic areas, such as, animal stream crossings.

- **Streambank and shoreline protection.** Using vegetation or structures to stabilize and protect banks of streams against scour and erosion (may require a stream channel alteration permit). When suitable riparian protection is initiated, streambank improvements are very effective.

- **Wetland development and restoration.** The construction or restoration of a wetland facility to provide the hydrological and biological benefits of a wetland. Establishing or improving wetlands is an excellent way to improve riparian areas and raise water tables to be utilized by forage plants.

- **Salting.** Salt blocks are useful for controlling animal distribution. Placing salt away from watering locations will help reduce time spent near water.

Summary

Utilizing grazing management strategies and improving pasture and riparian areas must not be identified as beneficial only to water quality, fish, or wildlife. Virtually all of these practices mentioned above result in some type of improvement in forage or water table levels which translates into improved productivity over the long term. Ranchette owners concerned with water quality as well as increased productivity should seek the proper technical assistance for the implementation of a plan to improve forage production, riparian areas, and animal watering capabilities.

Proper management of both pasture and riparian areas can benefit your property in the following ways:

- Creates diverse vegetation and root systems which protect and stabilize streambanks and lessens the likelihood of flooding.
- Elevates water table and saturated zone and increases subsurface water storage which will lessen the need for irrigation.
- Reduces stream channel icing in winter and decreases the chances of spring flooding.
- Improves aesthetic values and related property values.
- Increases quantity and quality of animal forage.
- Reduces soil erosion and off-site sediment delivery.
- Reduces the risk of both surface and ground-water contamination.

Worksheet 12

Pasture and Riparian Management (small ranchette-type operation)

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and **circle** the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15-30 minutes to complete the worksheet and summarize your risk rankings for pasture and riparian area management practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
RIPARIAN AREA MANAGEMENT *(Addressed in Fact/Worksheet 12, Section 1-5)*					
Streambank condition	More than 90% of the streambanks are stable with plant cover or large rocks. Little or no active erosion.	70-90% of the streambanks are stable with plant cover or large rocks. Some active erosion.	_____	Less than 70% of the streambanks are stable with plant cover or large rocks. Active erosion very evident.	____
Livestock access to stream	Stream fenced to exclude livestock.	_____	Limited livestock access to stream.	Livestock have unlimited access to stream.	____
Streamside (riparian) vegetation	Stream well shaded with trees and/or shrubs. Perennial plants dominate with few or no annual plants.	_____	Trees and/or shrubs providing some shade. Perennial plants dominate with some annual plants.	Little or no shade provided by trees and/or shrubs. Perennial or annual plants may dominate.	____
Streamside (riparian) vegetation trend	Streamside tree and/or shrub seedlings present and growing well.	_____	Streamside tree and/or shrub seedlings present but not growing well.	Streamside tree and/or shrub seedlings not present.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PASTURE MANAGEMENT *(Addressed in **Fact/Worksheet 12, Section 1**)*					
Grazing management	Two or more pastures used in rotation to allow plant rest. Grazing period begins at a 6" leaf length and ends at 3". Plant height at least 3" going into winter.	Pasture(s) not allowed rest, but grazing period begins at a 6" leaf length and ends with at least 3". Plant height at least 3" going into winter.	Two or more pastures used in rotation to allow plant rest but grazing period begins at less than a 6" leaf length and/or plants grazed shorter than 3". Plant height less than 3" going into winter.	Pasture(s) not allowed rest. Grazing period begins at less than a 6" leaf length and/or plants grazed shorter than 3". Plant height less than 3" going into winter.	____
Plant Health	Forage plants are healthy with dark green leaves, deep roots, and vigorous regrowth. Very few weeds. High production.	____	Forage plants somewhat unhealthy. Plant production beginning to decrease. Weeds increasing.	Forage plants are unhealthy and may have yellowish colored leaves, shallow roots, small size, or slow regrowth. Weeds common. Low production.	____
Heavy use area(s) (corrals, troughs, or salt areas with little or no protective plant cover)	Heavy use area(s) established well away from stream or irrigation ditch.	Heavy use area(s) established near stream or irrigation ditch, but runoff is diverted and/or captured.	Heavy use area(s) near stream or irrigation ditch and runoff is not diverted or captured.	Heavy use area(s) located adjacent to stream or irrigation ditch.	____
Irrigation (Complete only if irrigated)	Sprinkler irrigated with little runoff, OR surface irrigated with no stream in or adjacent to pasture, OR surface irrigated with tailwater captured.	Surface irrigated with 20' wide or greater buffer of ungrazed vegetation along the stream.	____	Surface irrigated with no buffer along the stream; tailwater is not captured.	____
Fertilizers	Fertilizers applied based on soil test or Extension guidelines and manure scattered with harrow, OR fertilizer not used and manure scattered.	Fertilizer applied based on soil test or Extension guidelines and manure not scattered, OR fertilizer not used and manure not scattered.	Fertilizer applied without soil test or Extension guidelines, but manure is scattered.	Fertilizer applied without soil test or extension guidelines and manure is not scattered.	____

What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

Pasture and Riparian Management Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Streambank condition				
Livestock				
Streamside (riparian) vegetation				
Streamside (riparian) vegetation trend				
Grazing management				
Plant Health				
Heavy use areas (corrals, stream crossings, et cetera)				
Irrigation				
Fertilizers				

Step 2: Look over your rankings for individual activities:

High Risk Practices (1) Pose a high risk for your health and for contaminating both surface and ground water.

Moderate to High Risk Practices (2) Are inadequate protection in many circumstances for both surface and ground water.

Low to Moderate Risk Practices (3) Provide reasonable surface and ground-water protection.

Low Risk Practices (4) Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action . The long term goal of the Home*A*Syst program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.

Step 3: Read the materials provided in this document, if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.

Contacts and References
Who to Call About...

Technical standards and design assistance

- Your local Soil Conservation District (SCD)
- Natural Resources Conservation Service (NRCS)
- Idaho Soil Conservation Commission (SCC)

Sources of Information about Financial Assistance

- Your county Farm Service Agency (FSA)
- Your local SCD
- NRCS
- Cooperative Extension System office (CES)
- Idaho Department of Fish and Game
- U.S. Fish and Wildlife Service (Acres for Wildlife)

References

- Clary, Warren R.; Webster, Bert F. 1990. Riparian Grazing Guidelines for the Intermountain Region, Rangelands 12 (4).
- Clary, Warren R.; Webster, Bert F. 1989. Managing Grazing of Riparian Areas in the Intermountain Region. Gen. Tech. Rept. INT-263. Ogden, UT.: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Livestock Grazing on Western Riparian Areas
- Idaho Agricultural Pollution Abatement Plan
- NRCS -- Field Office Technical Guide (Section IV)

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Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
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Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Assessing and reducing the risk of ground-water contamination

Site Evaluation

Keeping Idaho's Water Clean

Worksheet A

Why is the site evaluation important?

How homestead practices such as pesticide handling or wastewater disposal affect your ground water depends in part on the physical characteristics of the soil and geologic materials at your home site. These characteristics will control the physical and chemical response of contaminants that are introduced into the subsurface.

Although the focus of **Home*A*Syst** is on protection of the **ground water and drinking water**, preserving surface water quality is also important. Implementing the best management practices (BMPs) recommended in the fact sheets can also help protect **surface water** in two ways. First, implementing some BMPs may reduce runoff, which often carries significant amounts of contaminants to surface waterbodies. Second, because ground water is connected to surface water, contaminants that are transported to an aquifer may end up in downstream rivers, lakes, or wetlands. The dynamic interaction between surface and ground water is called **hydraulic continuity**. More information concerning hydraulic continuity can be found in the accompanying materials.

What is involved in completing this evaluation?

This evaluation has four parts:

Part 1: Evaluating the soil at your homestead
Part 2: Evaluating the geologic material at your homestead
Part 3: Combining the soil and geologic risk ranking
Part 4: Diagraming your homestead (optional)

Obtaining the information to complete parts 1 and 2 may require assistance from outside sources, such as your county Soil Conservation District (SCD), Natural Resources Conservation Service (NRCS) or Cooperative Extension System (CES) office. How long this takes will vary depending on availability of information in your county. Once you have the information, though, it should take about an hour to complete the first three parts of Worksheet A. The homestead diagram will take additional time.

Glossary
Site Evaluation

These definitions may help clarify some of the terms used in Worksheet A.

Basalt: A fine grained, dark colored volcanic rock (Example: Snake River Plain Basalt in south-eastern Idaho).

Bedrock: Solid rock that underlies soil or other unconsolidated material.

Granite: A light colored, silica rich rock formed by the slow cooling of molten rock (Example: Idaho Batholith in central Idaho).

Limestone: A rock that is mostly composed of calcium carbonate.

Microorganisms: An organism that is microscopic in size (Example: bacteria).

Organic matter: Matter containing carbon compounds that originated from plant and animal matter.

Perched water table: A soil or non-soil material that is saturated by water, but lies above the main water table. It is formed by water that infiltrates the soil and is collected on or restricted by an impermeable layer, such as a clay lens.

Pore space: The space between individual grains of a sediment or rock.

Permeability: The quality that enables water or air to move through soil or rock. The opposite of permeable is "impermeable" (Example: Clay is relatively impermeable as compared to sand).

Soil classification: A system to provide detailed soil descriptions. The descriptions are based on soil properties such as color, texture, pH, organic content, and soil depth.

Soil drainage class: The condition of water saturation or partial saturation that existed during the development of the soils. Different classes are described by such terms as excessively drained, well drained, and poorly drained.

Soil horizon: A layer of soil that has distinct characteristics, such as color or texture. Soils are grouped as A, B, C horizons.

Soil mapping unit: A soil or combination of soils drawn on a map and where possible include unit names.

Soil series: Soils that are essentially alike in all major characteristics.

Soil texture: The relative proportions of sand, silt, and clay that make up a soil. Described in terms such as sandy loam and silty clay.

Subsoil: The B soil horizon.

Unconsolidated alluvium: Deposits of clay, silt, sand, gravel, and boulders. These sediments have been deposited by water from glaciers, rivers, lakes, etc.

Water table: The zone in the soil or subsurface that is saturated with water. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment.

How do soils affect the potential for ground-water contamination?

Soil characteristics are very important in determining whether a contaminant breaks down to harmless compounds or leaches into ground water. Because most contaminant breakdown occurs in the soil, a greater potential for ground-water contamination exists in areas where contaminants are able to move quickly through the soil.

While held to soil particles, contaminants are broken down by bacteria and other soil organisms and by chemical reactions with minerals and natural chemicals in the soil. Most of this chemical and biological breakdown takes place in the surface layers, where the soil may be warm, moist, high in organic matter, and well aerated.

Sandy soils have large pore spaces between individual particles, and dissolved contaminants can move rapidly through the soil and into ground water. Also, sandy soils provide little surface area onto which contaminants can become attached or "adsorbed." On the other hand, clay soils are made of very small particles which slow the movement of water and dissolved contaminants through the soil. Some contaminants become strongly attached to clay particles. And finally, soils that are high in organic matter provide an excellent environment for chemical and biological breakdown of contaminants.

How do subsurface and geologic materials affect the potential for ground-water contamination?

Materials that lie below the soil, or geologic materials, vary depending on where you are located geographically. In Idaho, this material varies from deposits of clay, silt, sands, gravels, and cobbles (called unconsolidated alluvium), basalt, mixed layers of volcanic deposits and sediments, granite, or in a few areas, limestone.

The nature of the materials can affect the potential for ground-water contamination. Contaminants can move very quickly through deposits of sand, gravel, and cobble, fractured basalt or granite, or limestone with connected solution cavities. On the other hand, deposits of clay and silt will slow the movement of contaminants.

In general, it can be said that all the major ground-water systems in Idaho have either medium high to high potential for becoming contaminated. The presence or absence of clay above the water table seems to be the leading factor that reduces the potential for contamination. Another factor, the depth to the water table, has often been observed to be a much less significant factor.

A word of caution

As with the results of the previous assessment worksheets, use the rankings from this worksheet cautiously. Many factors affect whether or not a contaminant will reach the ground water. There is no guarantee that a "low risk" site will be uncontaminated, or that ground water will become contaminated at a "high risk" site. The type of contaminant involved, how you handle and store potential contaminants, and many other factors can affect the potential for ground-water contamination.

Part 1: Evaluating the Soil on Your Homestead

To complete your soil evaluation, you will need a copy of your county's soil survey report. This report is available at most county Soil Conservation District (SCD), Cooperative Extension System (CES), or Natural Resources Conservation Service (NRCS) offices.

NOTE: If you would like assistance in this part, ask you local CES, NRCS, or SCD personnel for help. It is important that this portion of the evaluation be done.

Step 1: Identify the soils.

- Locate your homestead on the aerial photo in the county soil survey.
- Note the soil mapping unit indicated on the photo, identify the unit name, and find the information on that unit in the written section of the report.
- Transform the soil mapping unit boundary lines from the soil survey to the homestead diagram on page 12.

Step 2: Rank the soil unit(s)

- Using the information found from Step 1, rank your soil using the "Soil Characteristics" section on the next 3 pages. If there is more than one soil mapping unit on your property, rank each one individually and enter the score in the spaces provided.

Soil characteristics

For the following characteristics, consult the tables for each soil mapping unit and the soil mapping unit or soil series text in your county soil survey. Help on where to locate information is found in the help box on the left side.

		Score
1. Texture of soil surface layer (A Horizon)	loam, silt loam, sandy clay loam, silt	9
	clay, sandy clay, silty clay, clay loam, silty clay loam	8
	loamy fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam	4
	sand, loamy sand, sandy loam, organic materials (all "0" horizons), and gravelly loam	1

HELP.

Map unit name or map unit description will include texture of surface horizon.

Your score(s) soil 1 ____ soil 2 ____ soil 3 ____

2. Texture of subsoil layer (B Horizon) or 2 feet below the A Horizon

clay, sandy clay, silty clay, silt	10
sandy clay loam, loam, silt loam, clay loam, silty clay loam	7
loamy fine sand, loamy very fine sand fine sandy loam, very fine sandy loam	4
sand, loamy sand, sandy loam, organic materials, and gravelly loam	1

HELP.
Subsoil information can be found in the map unit description or soil series description.

Your score(s) soil 1 _____ soil 2 _____ soil 3 _____

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3. ph of soil surface (A Horizon)

pH is 6.6 or greater or described as neutral, mildly alkaline, moderately alkaline, or strongly alkaline	6
pH is less than 6.6; described as slightly acid, moderately acid, or strongly acid	4

HELP.
pH information can be found in the soil series description.

Your score(s) soil 1 _____ soil 2 _____ soil 3 _____

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4. Thickness of the A and B Horizons

60 inches or greater	10
40-59 inches	8
30-39 inches	5
less than 30 inches	1

HELP.
The thickness of the A and B horizons can be found in the soil series description.

Your score(s) soil 1 _____ soil 2 _____ soil 3 _____

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5. Soil drainage classification

well drained	10
well to moderately well drained	7
moderately well drained	4
somewhat poorly, poorly, and very poorly drained; somewhat excessively and excessively drained	1

HELP.
Drainage information can be found in the soil series description.

Your score(s) soil 1 _____ soil 2 _____ soil 3 _____

6. Permeability of subsoil (B horizon)

a. If bedrock is found within 20 to 40 inches of the surface, use the following to assign a rank:

HELP.
Depth to bedrock information can be found in the soil series description.

	Score
bedrock at 21–40 inches	3
bedrock within 20 inches	1

b. If there is no bedrock near the surface, rank the permeability of the subsoil horizon using the following descriptions.

HELP.
Permeability of the subsoil horizon can be found in the soil series description.

very slow, slow, and moderately slow	10
moderate	8
moderately rapid	3
rapid to very rapid	1

Your Score(s) _____ _____ _____
soil 1 **soil 2** **soil 3**

7. Organic matter content (%) (Ap horizon or 0-6"depth from surface)

HELP.
This information can be found in the table on "Physical and Chemical Properties of the Soil" in newer soil surveys. It can also be found in a soil test report if organic matter was requested, or by contacting you local NRCS office.

high (4-10%)	10
medium (2-4%)	7
moderately low (1-2%)	5
low (0.5-1%)	3
very low (less than 0.5%)	1

Your Score(s) _____ _____ _____
soil 1 **soil 2** **soil 3**

Step 3: Add your seven scores together for each soil you ranked.

Total(s)	soil 1	soil 2	soil 3

Step 4: In the box below, in the left column, find the range within which your total score lies. From the total score, move horizontally to the middle column and identify your soil's "potential to protect ground water." Then find the risk rank number assigned to your score.

Total Score	*Soil Potential to Protect Ground Water*	*Risk Rank*
51+	**Good**	**4**
41-50	**Fair**	**3**
31-40	**Marginal**	**2**
0-30	**Poor**	**1**

Step 5: Enter risk rank number(s) here:

Soil	Risk Rank
1	
2	
3	

Step 6: Understand what your soil risk rank means.

In soils with a score of more than 50 points (*risk rank 4*), potential contaminants move slowly, allowing them to become attached to soil particles. Sunlight, air, and microorganisms then have the potential to break down the contaminants. The ground-water contamination risk level may be lowered.

In a soil with a score of 30 or less (*risk rank 1*), most contaminants move rapidly down toward the water table and are not degraded.

In soils with a score between 30 and 50 (*risk rank 2 and 3*), potential contaminants will move more slowly than in soils of *rank 1* but more rapidly than soils with a *rank 4*. Potential contaminants may be somewhat degraded and the risk for ground-water contamination may be somewhat reduced.

Overall, the higher your risk rank number, the more likely that your soil conditions will help to reduce the risk of ground-water contamination from homestead practices.

Part 2: Evaluating Geologic Materials Beneath Your Homestead

This part looks at the geologic materials beneath your homestead soils. By combining both the soil and the geology evaluation (Part 3), there will be a much clearer picture of your site's potential for keeping pollutants out of ground water.

For simplification, we are considering all ground-water systems, whether it is in basalt, unconsolidated alluvium, etc., to have a high potential for contamination unless there are clay layers present over a wide spread area. Thus this evaluation requires the knowledge of the presence or absence of clay layers above the water table. This information can be obtained from the following sources:

• A well log description of your well or if that is not available, from a well log description from the nearest neighboring well. Well logs for wells drilled after 1972 should be on file with the Idaho Department of Water Resources (IDWR). IDWR has regional offices in the following areas:

North (Coeur d' Alene):	(208) 769-1422
Southwest (Boise):	(208) 334-2190
South Central (Twin Falls):	(208) 736-3033
Eastern (Idaho Falls):	(208) 525-7161

Be prepared to provide the legal description (*county, township, range, section, and 1/4 of a 1/4 section or 40 acres*) of the well location. If known, provide the year the well was installed and the owner's name at that time. A nominal amount may be charged for copying the log.

• Published hydrogeological reports. The United States Geological Survey (USGS), IDWR, Division of Environmental Quality (DEQ), and universities and colleges are organizations that may have a report that covers your area.

Step 1: Find the information you need from the suggested sources.

Step 2: Read the well log description or the hydrogeologic description to determine if there are any clay layers above the water table at your homestead.

Step 3: If there are abundant clay layers present, your rank is 3.
If there are minimal clay layers present, your rank is 2.
If there are no clay layers present, your rank is 1.

Step 4: Place your geologic risk rank here. **Geologic Risk Rank** ☐

Geologic Risk Rank	Level of Risk of Ground-water Contamination
1	High
2	Moderate
3	Low

Part 3: Combining the Soil and Geologic Risk Rankings

Combining the rankings from parts 1 and 2 will provide you with a good overall ranking of your homestead site's potential to keep pollutants from moving down to ground water.

Step 1: Transfer your boxed rankings from the soil evaluation (part 1, page 7) and the geologic rank (part 2, page 8) to the boxes below.

Soil 1 Rank	☐	**Geological Rank**	☐
Soil 2 Rank	☐		
Soil 3 Rank	☐		

Step 2: The table below shows the overall level of ground-water contamination risk associated with your homestead site conditions. Find your two numbers **written in the correct sequence** (soils rank---geological rank) and circle the sequence.

Combined Level of Risk		
Low Risk (Rank 3)	**Moderate Risk (Rank 2)**	**High Risk (Rank 1)**
2-3	**1-3**	**1-1**
3-3	**2-2**	**1-2**
4-3	**3-2**	**2-1**
	4-2	**3-1**
	4-1	

Step 3: Look above the sequence you circled to find your risk level and your rank. (For example, if your numbers are 3-2, your site is in the moderate risk column and your rank is 2).

Step 4: Enter your combined rank here. (If you calculated more than one soils ranking, calculate a combined ranking for each soil's ranking)

Combined Rank 1 ☐

Combined Rank 2 ☐

Combined Rank 3 ☐

Step 5: Understand your combined rank.

For instance, a site with a combined rank of 3 (low ground-water pollution risk) will have a soil with a good capacity to hold and break down contaminants. Its subsurface condition will also keep contaminants from reaching the water table. Under certain conditions, however, such as spills, heavy rainfall, or poor management, contaminants may reach ground water.

On the other hand, if you carefully manage a site with a combined rank of 1 (high ground-water pollution risk), you may not affect your drinking water. **Both site characteristics and your management practices are of equal importance.**

Your three site ranks (soils rank, geologic rank, and combined rank) will be used again in Worksheet B. They will be combined with your risk rankings for specific activities from the assessment of potential ground-water contamination on your homestead.

If you have more than one soil on your homestead, you will need to transfer individual soil ranks and combined ranks to Worksheet B. It will be especially important for you to complete part 4 of this worksheet if you have more than one soil on your homestead, so that you can link particular site vulnerability with each homestead activity.

You may now proceed with part 4 of this worksheet, or you may go directly to Worksheet B.

Part 4: Learning More About Your Site

Sketching a diagram of your homestead can provide useful information to help you understand how the physical layout, site characteristics of your homestead, and location of activities may contribute to, or lessen, the possibility of contaminants reaching your drinking water.

Step 1: Begin by looking at the sample diagram on the following page.

Step 2: Sketch a diagram of your homestead on the blank grid provided on page 12 and include the following items:

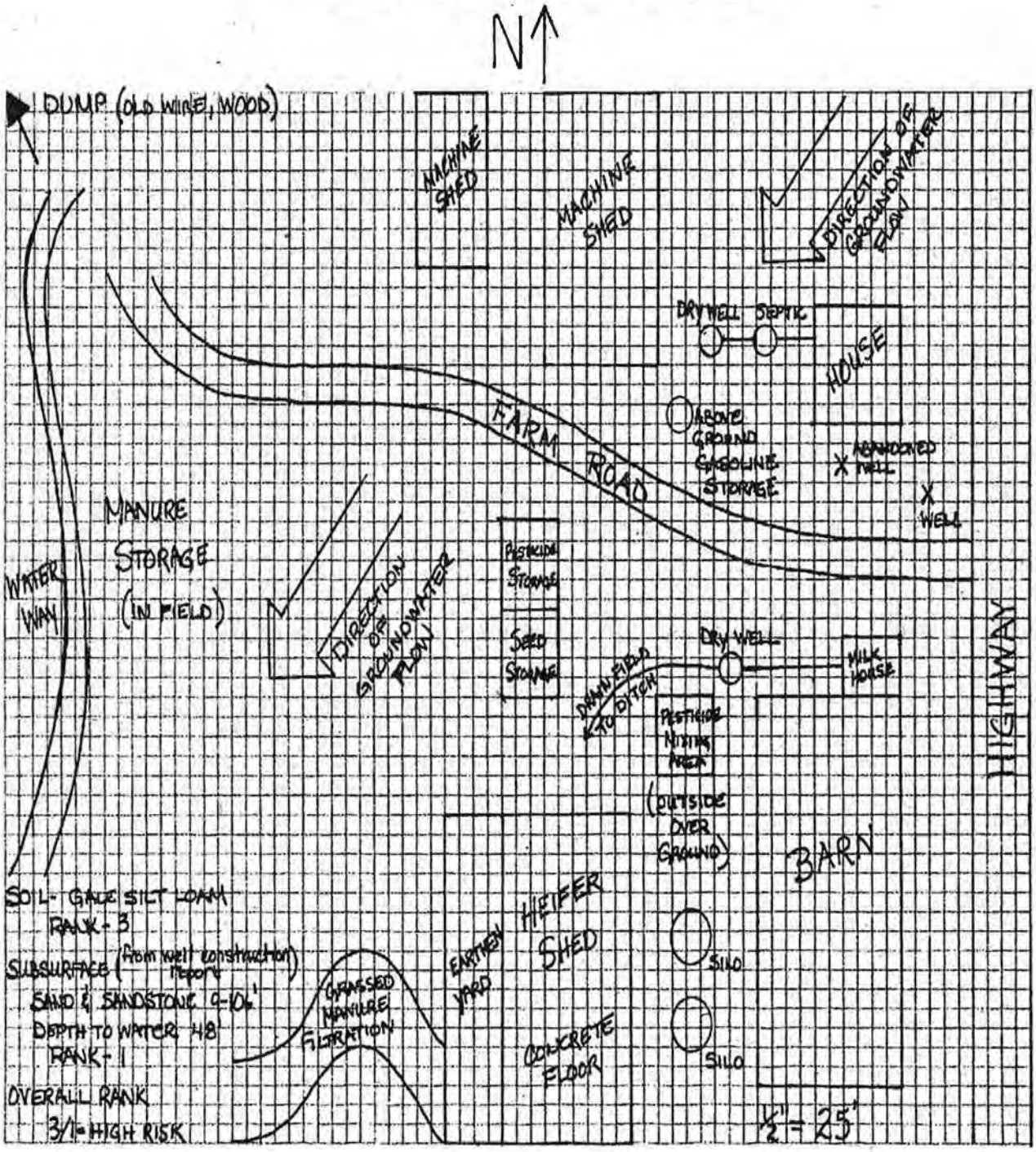
-buildings and structures
-wells and unused wells
-septic system (tank, dry well, absorption field)
-animal lots (current and/or abandoned)
-manure storage (temporary and permanent)
-underground storage tanks
-above ground storage tanks
-pesticide and fertilizer storage
-silage storage
-milkhouse waste disposal system (tank, field and/or ditch)
-farm dumps
-vehicle maintenance areas
-liquid disposal areas
-tile and open ditch drains
-surface water (ponds, streams, irrigation canals)
-direction of landslope
-direction of groundwater flow
-different soil types

You can use the same diagram to indicate surface water (ponds and streams), direction of landslope, ground-water flow, and the different soil types found around your homestead. Generally, ground water follows surface topography and moves downhill towards surface water.

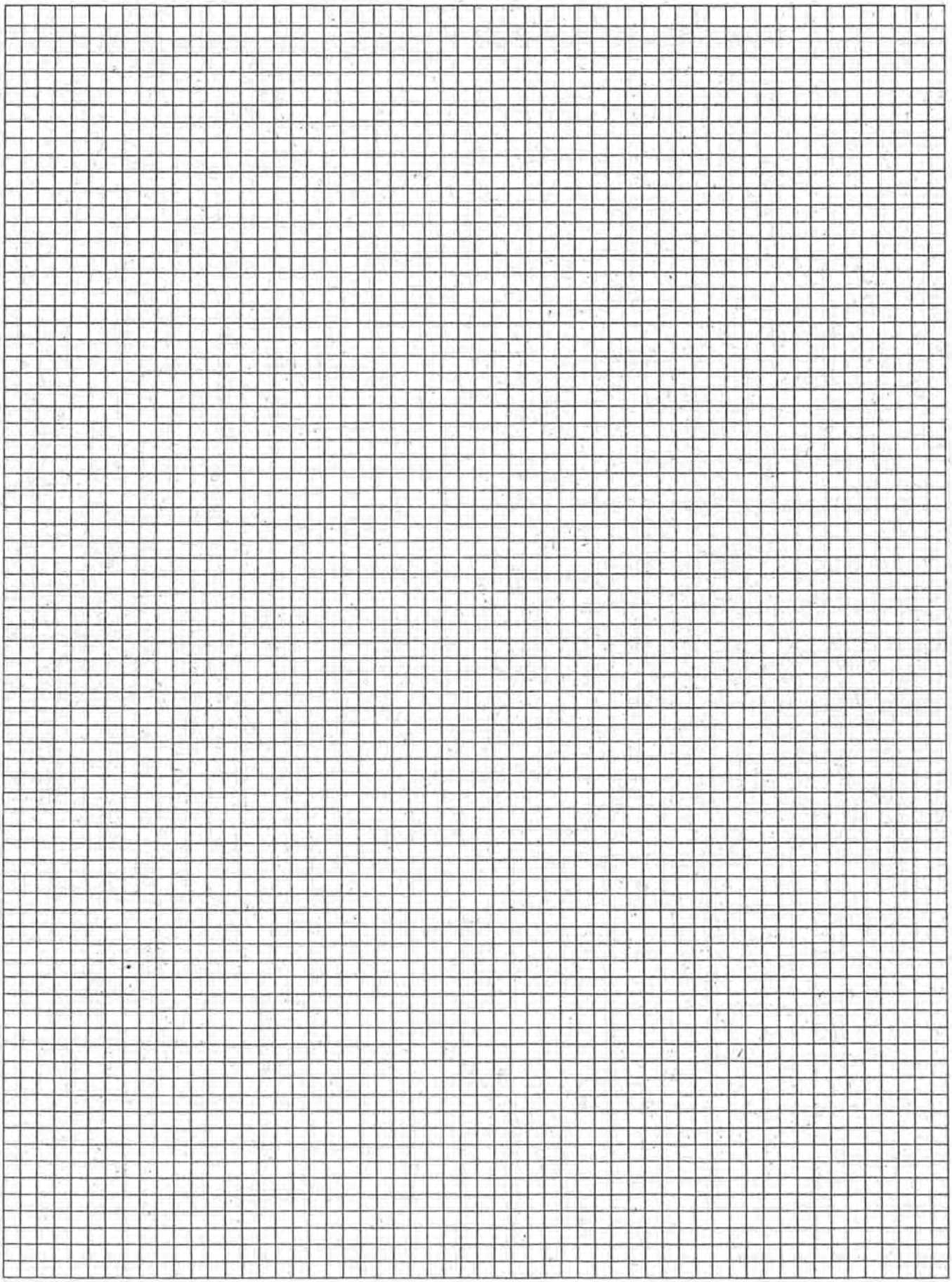
Step 3: Use your diagram to note which activities or structures on your homestead have a greater likelihood of allowing contaminants to reach ground water. This information should help prepare you to make better decisions about your homestead activities and structures and how they might be affecting your drinking water.

Step 4: When you've completed the diagram of your homestead, go on to Worksheet B.

Sample Homestead Diagram



YOUR HOMESTEAD DIAGRAM



NOTES

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Idaho Association of Soil Conservation Districts (IASCD)
Idaho Department of Agriculture (IDA)
Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ)
Idaho Department of Water Resource (IDWR)
Idaho Public Health Districts
Idaho Soil Conservation Commission (SCC)
Idaho Water Resources Research Institute (IWRRI)
University of Idaho-Cooperative Extension System (CES)
USDA-Farm Service Agency (FSA)
USDA-Natural Resources Conservation Service (NRCS)
USDA-Rural Economic and Community Development (RECD)
U.S. Environmental Protection Agency (EPA)

Adapted for Idaho from material developed by the **Washington Home *A* Syst and Wisconsin Farm*A*Syst Programs. Idaho Home*A*Syst** development was supported by the **National Farmstead Assessment Program.**

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Published 1996.

Assessing and reducing the risk of ground-water contamination

Keeping Idaho's Water Clean

Overall Homestead Assessment and Action Plan

Worksheet B

Congratulations! With the completion of the worksheets appropiate to your homestesd activities, you have nearly finished the evaluation part of the Home*A*Syst program. You have assigned relative risk rankings to your homestead practices and structures which reflect ground-water contamination potential. At this point you should have a good idea of which activities present the greatest potential to contaminate your drinking water and ground-water quality.

The next step in the Home*A*Syst program is to develope an **action plan** to correct high-risk practices. On pages two, three, and four of this worksheet, you will list those activities which landed in the shaded areas of the risk ranking summary tables of the worksheets you used. The remaining columns of the table below will help you prioritize steps you can take to better protect the drinking water and ground-water supplies of your homestead and your neighbors.

Step 1: If you haven't already done so, go back to the worksheets used and identify any individual activities or structures that you ranked in the shaded areas of the risk ranking summary tables.

Step 2: List each activity of concern on the chart on pages two, three, and four. Begin by filling in the first three blanks (to the left of the double vertical line on the chart). Do this for each of the worksheets you completed.

Step 3: Then, for each activitiy that you listed, fill in the "response options" and "taking action" sections to the right of the double vertical line on the chart.

- **Response options:** Check one of the two boxes; either "immediate action possible" or "further planning required." This should be a quick assessment of whether a change in practice requires major effort and money (like relocating a well or building a pesticide storage facility) or whether it requires a change in practice (like cleaning an animal lot more often or being sure that stored pesticides are clearly labeled).

- **Taking action:** Decide on a possible first step to take right now to begin to address each concern listed. It might be reducing your purchases of chemical household cleaners, or cleaning your milking center settling tank right away, or making a first phone call to get information about relocating and redesigning your pesticide storage area.

The first step for a concern that you identified as "immediate action possible" should , of course, be easier than a first step for a major or costly project. But, whatever the area of concern , what's an initial step you can take to begin to address each of the high-risk concerns you have listed?

Step 4: Keep this list handy and refer to it often. It provides important information for you as you begin to more effectively protect the ground water that provides drinking water to you and your family.

High-Risk Activities

A list of individual activities or structures that ranked in the shaded areas of your Home*A*Syst worksheets

After completing each of the assessments appropriate to your homestead, list **any individual activities or structures** that you ranked in the shaded areas of the risk rating summary table of each worksheet. Fill in the worksheet number and name, and the individual activity of concern. Indicate whether your response will be immediate or longer term. Finally, note your initial action to remedy the concern.

Work-sheet #	Worksheet name	Individual activity identified as being high risk	Response Options (check one)		Taking Action (proposed first step to address concern)
			Immediate action possible (change in practice only; cost not a factor)	**Further planning required** (requires major structural improvement or relocation; involves major effort or high cost)	

(Continue listing on next page as necessary.)

Work-sheet #	Worksheet name	Individual activity identified as being high risk	Response Options (check one)		Taking Action (proposed first step to address concern)
			Immediate action possible (change in practice only; cost not a factor)	Further planning required (requires major structural improve-ment or relocation; involves major effort or high cost)	

Work-sheet #	Worksheet name	Individual activity identified as being high risk	**Response Options** (check one)		**Taking Action** (proposed first step to address concern)
			Immediate action possible (change in practice only; cost not a factor)	Further planning required (requires major structural improvement or relocation; involves major effort or high cost)	

A few final words

After doing all you can to protect your drinking water from contamination on your homestead, you may still get well tests showing some contaminants.

- One factor could be activities away from the homestead. Nitrates could be leaching from your fields, for example.

- Problems could originate in more distant areas, too. Depending on the geology on an area, activities miles away can result in contamination of the ground water slowly moving toward your property and the ground water you drink. It may take years for a spill on someone else's land to show up in your well. Leaking petroleum tanks, farm dumps, and waste pits away from your property all have the potential to affect your drinking water -- just as activities on your land have the potential to affect the drinking water of your neighbors and even others living miles away from you.

You may want to keep track of potential sources of ground-water contamination in your area. Also, you may want to encourage your neighbors to use this assessment.

On the other hand, even if your well water tests are good, your worksheet results may show the need for changes. Your well may be upslope from your home, so the water drawn from that area is not affected by your activities. That doesn't mean, that your activities are not affecting someone else's drinking water. You need to be as careful as you can, especially if you are on land vulnerable to ground-water contamination.

You may have quite a few "high-risk" pollution potential rankings. You may also be concerned about your well water test and want to know more about how your activities might have influenced the results. If so, you may want to ask for help to look more closely at potential sources in your area to determine the causes of the contamination in your drinking water.

For further information about potential sources of ground-water contamination on your homestead, contact your county Cooperative Extension System, Soil Conservation District, or Natural Resources Conservation Service office.

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