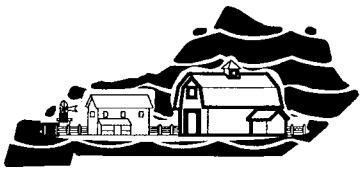

KY•A•Syst

Home and Farmstead
Water Quality Assessment

Assessing and Reducing the Risk of Groundwater Contamination from

LIVESTOCK WASTE STORAGE

Why should I be concerned?

Kentucky's groundwater is one of its most vital resources. It supplies drinking water for hundreds of thousands of Kentuckians. Groundwater is the source of water for drinking water wells, springs, and some municipal, or "city," water supplies. All of us do things at our homes every day which can possibly pollute the groundwater. Nobody wants to pollute the groundwater, but if we are not careful and educated about how we manage our day-to-day home or farmstead activities, we can do just that– pollute the groundwater that serves as drinking water for many families. Even if nobody in your community uses groundwater for drinking water, you need to be concerned. This is because groundwater that underlies your home may travel a long way and eventually end up as another family's drinking water.

Storing livestock waste allows farmers to spread manure when the time is right for nutrient use by crops. Accumulating manure in a concentrated area, however, may be risky to the environment and to human and animal health. Manure may contribute nutrients and disease-causing organisms to both surface water and groundwater.

Facilities for storing liquid manure on the farmstead sometimes may leak, releasing large volumes of pollutants. An earthen pit used for manure storage develops a semi-impervious seal as the organic matter in the stored manure plugs the spaces between the soil particles of the pit floor and walls, thus limiting the seeping of fluids from the pit. Continuous usage of an earthen manure storage pit maintains this seal, but intermittent use will allow the seal to deteriorate. Short-term solid manure storage and abandoned manure storage areas with dirt floors may be sources of groundwater contamination by nitrates.

Livestock waste is one source of both nitrate and bacterial contamination of groundwater. Nitrate levels in drinking water above federal and state drinking water standards of 10 parts per million (ppm) nitrate-nitrogen can pose health problems for infants. High nitrate levels can also affect adults and young livestock. Fecal and coliform bacteria in livestock waste can contaminate groundwater, causing such diseases as dysentery, typhoid, and hepatitis.

The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.

How will this publication help me protect the groundwater?

Part I of this publication will help you protect the groundwater by asking you questions about your livestock waste storage structures and practices. These questions will help you identify activities or structures on your property which may put groundwater at a high risk of being contaminated. Part II of the publication will give suggestions on how to reduce the risk of groundwater contamination by improving your livestock waste storage structures and practices.

The KY•A•Syst program is for your benefit only. No information from this publication needs to leave your home. KY•A•Syst does not attempt to offer legal advice or solutions to individual problems but rather to raise general awareness about groundwater protection strategies. Questions about individual problems should be addressed to the appropriate professional.

Part I. *Assessing* the Risk of Groundwater Contamination from Livestock Waste Storage

Instructions:
Circle the number in front of the appropriate item that **best** describes your home or farmstead. (Skip and leave blank any categories that don't apply to your home or farmstead.)

LONG-TERM WASTE STORAGE (180 days or more)

***Option #1* – If waste is stored in a poured-concrete structure (liquid-tight design), answer this question; if not, move on to Option #2.**

Describe the design, installation, and condition of the poured concrete structure.

4 Designed and installed according to plans from the Soil Conservation Service or other engineering firm. Properly maintained.

3 Designed and installed according to plans from the Soil Conservation Service or other engineering firm. Not maintained.

2 Not designed by Soil Conservation Service or other engineering firm. Concrete cracked, constructed in medium-textured soils (silt loam, loam).

1 Not designed by Soil Conservation Service or other engineering firm. Concrete cracked, constructed in coarse-textured soils (sands, sandy loam). Farm is in an area which has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or the water table is within 20 feet of surface.

***Option #2* – If waste is stored in a clay-lined waste storage pit/lagoon (below ground), answer this question; if not, move on to Option #3.**

Describe the design, installation, and condition of the clay-lined waste storage pit/lagoon.

4 ----------

3 Designed and installed according to plans from the Soil Conservation Service or other engineering firm. Properly maintained.

2 Not designed by Soil Conservation Service or other engineering firm. Constructed in medium- or fine-textured dense materials (silt loam, loam, clay loams, silty clay). Clay lining eroding or loss of clay compaction.

1 Not designed by Soil Conservation Service or other engineering firm. Constructed in course-textured materials (sands, sandy loam). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or the water table is within 20 feet of surface.

***Option #3* – If waste is stored in an earthen waste storage pit/lagoon (below ground–no clay liner used), answer this question; if not, move on to Option #4.**

Describe the design, installation, and condition of the earthen waste storage pit.

4 ----------

3 Designed and installed according to plans from the Soil Conservation Service or other engineering firm. Clay content of site determined sufficient by Soil Conservation Service to bypass the installation of a clay liner. Clay compacted using roller or other equipment.

2 Designed and installed according to plans from the Soil Conservation Service or other engineering firm. Constructed in medium- or fine-textured dense materials (silt loam, clay loams, silty clay). Pit/lagoon is in continuous use; manure has formed a seal in the pit/lagoon.

1 Not designed by Soil Conservation Service or other engineering firm. Constructed in coarse-textured soils (loam, sands, sandy loam). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface. Pit/lagoon is more than 10 years old. Pit/lagoon is not in continuous use; seal of pit has cracks.

***Option #4* – If you do not have a long-term livestock waste storage system, you are at a high risk of contaminating groundwater and/or surface water. Consult your local Soil Conservation Service for help with designing a livestock waste storage system.**

4 ----------

3 ----------

2 ----------

1 No long-term livestock waste storage system for confined animals (violates Kentucky regulations).

SHORT-TERM WASTE STORAGE (usually 30 to 90 days)

If waste is stored on a stack pad, describe the stack pad.

4 Stack pad designed and installed according to plans from the Soil Conservation Service or other engineering firm. Has concrete surface, a roof, and has sides of concrete or wood. Surface water is diverted from reaching the stack pad. Liquids seep from stack pad to appropriate long-term storage (pit/lagoon).

3 Stack pad designed and installed according to plans from the Soil Conservation Service or other engineering firm. Has concrete surface and sides of concrete or wood. No roof over stack pad. Surface water is not diverted from reaching the stack pad. Liquids seep from stack pad to appropriate long-term storage (pit/lagoon).

2 Stack pad not designed by the Soil Conservation Service or other engineering firm. Has concrete surface and sides of concrete or wood. No roof over stack pad. Surface water not diverted from reaching the stack pad. Liquids seep from stack pad to appropriate long-term storage (pit/lagoon).

1 Stack pad not designed by the Soil Conservation Service or other engineering firm. Has concrete surface and sides or concrete or wood. No roof over stack pad. Surface water not diverted from reaching the stack pad. No long-term liquid storage facility (pit/lagoon) is used for confined animals (violates Kentucky regulations).

If waste is stacked in yard without a stack pad, describe the yard.

4 Covered, concrete yard with curbs and gutters. Liquids run off to appropriate long-term storage facility (pit or lagoon).

3 Yard has concrete surface with curbs (no roof). Liquids run off to an appropriate long-term storage facility (pit or lagoon).

2 Yard has concrete surface (no roof or curbs). Surface water not diverted from reaching the yard. Liquids run off to an appropriate long-term storage facility (pit or lagoon).

1 Yard has earthen surface (no roof or curbs). Surface water not diverted from reaching the yard. No long-term liquid storage facility (pit/lagoon) is used for confined animals (violates Kentucky regulations). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

If waste is stacked in the field (on soil base), is it on high ground? What type of soil is it stacked on?

4 ----------

3 Stacked on high ground. Medium- or fine-textured soils (silt loam, loam, clay loams, silty clay). Waste covered with anchored plastic or tarp.

2 Stacked on high ground. Waste uncovered. Medium- or fine-textured soils (silt loam, loam, clay loams, silty clay).

1 Stacked on high ground. Waste uncovered. Coarse-textured soils (sands, sandy loam). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

LOCATION

Where is the location of livestock waste storage in relation to any water resource (well, spring, stream, pond, etc.) or sinkhole?

4 Manure stack (on soil) or earthen waste storage pit/lagoon more than 250 feet downhill from any water resource or sinkhole. Manure storage structure (liquid-tight pit/lagoon) more than 100 feet downhill from any water resource or sinkhole.

3 Manure stack (on soil) or earthen waste storage pit more than 250 feet uphill from any water resource or sinkhole. Manure storage structure (liquid-tight pit/lagoon) more than 100 feet uphill from any water resource or sinkhole.

2 Manure stack (on soil) or earthen waste storage pit less than 250 feet downhill from any water resource or sinkhole. Manure storage structure (liquid-tight pit/lagoon) less than 100 feet downhill from any water resource or sinkhole.

1 Manure stack (on soil) or earthen waste storage pit less than 250 feet uphill from any water resource or sinkhole. Manure storage structure (liquid-tight pit/lagoon) less than 100 feet uphill from any water resource or sinkhole.

DEAD ANIMAL DISPOSAL

How do you dispose of dead animals?

4 Dead animals composted **OR** brought to/picked up by renderer.

3 Dead animals incinerated.

2 Dead animals buried or disposed of in dead animal pit.

1 No system for disposal of dead animals.

SITE EVALUATION

What type of soil is on your property?

4 Fine-textured or "heavy" soils (clays).

3 Medium-textured soils (silt loam).

2 Medium- to coarse-textured soils (loam, sandy loam).

1 Coarse-textured soils (sands).

After a 1-inch rain in April, how long do you (or farmers in your area) have to wait to get into the field?

4 More than four days.

3 Four days.

2 Three days.

1 Zero to two days.

How sensitive is your region of the state to groundwater contamination (see map at end of publication)?

4 Low sensitivity.

3 Moderate sensitivity.

2 High sensitivity.

1 Very high sensitivity.

Does your property lie above or near any active/abandoned underground coal mines?

4 No underground mining is being done below or near your property.

3 Underground mining is currently being done.

2 An underground mine was abandoned underneath or near your property more than ten years ago.

1 An underground mine was abandoned underneath or near your property more than twenty years ago.

If your property does lie above or near any active/abandoned underground coal mines, what type of mine is it, and how deep is the mine? (See Part II for more information.)

4 No underground mining is being done below or near your property.

3 Underground mine is more than 400 feet deep.

2 Underground mine is 200 to 400 feet deep.

1 Underground mine is less than 200 feet deep. Mine is a "longwall" type mine.

What do I do with these rankings?

Take a look at your rankings for the individual questions you answered.

For Questions Where You Received A:	The Risk of Contaminating Groundwater Is:
4	Low
3	Low to Moderate
2	Moderate to High
1	High

Use this table to list any questions from Part I where you received a "1" (high risk activity or structure), or that were identified as being against Kentucky regulations. Next, write down the first step that can be taken to better the situation. Then read Part II of this publication, "Reducing the Risk of Groundwater Contamination by Improving Livestock Waste Storage." This will help you to improve any problem areas (1's or 2's) which were identified.

Activity or structure identified as high risk ("1")	**What is the first step that can be taken to solve the problem?**
Example: manure is stacked on soil within 250 feet of any well, spring, sinkhole, etc.	*Stack manure more than 250 feet from any well, spring, sinkhole, etc.*

Part II. *Reducing* the Risk of Groundwater Contamination by Improving Livestock Waste Storage

Storage of livestock wastes involves accumulating wastes in some type of structure for a period of time. From an environmental standpoint, this waste storage can be either positive or negative. Risks arise when livestock waste that might be spread on the land surface, at rates that would not cause environmental problems, is instead collected in one large amount. Livestock waste is defined as a combination of manure, feed, dirt, bedding or litter, and water. Manure is animal feces and urine.

The environmental safety of collecting and storing large amounts of livestock waste in one place for an extended period depends on three things:

1) The design, construction, and management of the storage facility;
2) The proper land application of the livestock waste once it leaves the storage facility;
3) The physical and chemical characteristics of the soil and subsurface geologic materials within the storage area, the soil and subsurface geologic materials of the surrounding area to which any runoff might flow, and the chance of a major rainfall (ex. 25 year, 24 hr. storm).

Waste storage is an important management option available to livestock producers. Stored waste can be applied to the soil when crops are not actively growing and the soils are open. This allows waste to be injected or incorporated by tillage immediately following application. Handling waste in this way ensures that the farmer will receive the maximum fertilizer value from the waste materials, while reducing the risks of groundwater and surface water contamination.

Stored waste should be sampled and tested to determine how much nitrogen, phosphorus, and potassium it contains. (When sampling waste materials, be sure to obtain a representative sample. In confinement buildings take all the safety precautions concerning poisonous gases.) This information, combined with a knowledge of the amount of manure applied per acre and of the current nutrient levels in the soil (from soil samples) enables a farmer to determine whether additional commercial fertilizer is needed to meet realistic crop production goals.

Waste storage also reduces the need for land application during winter months when the soil is frozen. This saves wear and tear on farm equipment, conserves nutrients contained in the manure, and minimizes erosion and runoff. Storage is also valuable during extended periods of bad weather and when crops are actively growing, making application difficult or impossible.

In almost all cases, spreading manure will cause contamination of surface water if not incorporated. Snow melt and spring rains before the frost is gone will cause nutrient loss due to runoff. Manure spread to frozen soil is not able to infiltrate into the soil and therefore runs off into streams. In some instances, manure spread on level ground at large distances from surface and groundwater sources may cause minimal contamination.

LONG-TERM STORAGE

Livestock wastes can be stored either in solid, semi-solid, or liquid form.

- Facilities for storing solid wastes use walls and slabs for stacked or pushed waste.
- Semi-solid wastes are moved (scraped, flushed, or flushed and pumped) into containment facilities when solids are separated from liquids.
- Liquid waste is stored in tanks, pits, or earthen lagoons.

Concrete and clay are commonly used construction materials for waste storage structures. Groundwater contamination may occur if the facility is not structurally sound, allowing waste materials to seep into the groundwater supply. Storage capacity must be large enough to allow for periods of the year when waste cannot be applied to fields (late fall to spring). A threat to surface water exists if storage units are not emptied frequently enough, allowing wastes to overflow the structure. Liquid storage systems require the use of pumps and pipes for moving wastes from the barn to the storage structure. These systems must be carefully installed and maintained to ensure that they do not leak.

Each time a storage facility is emptied, carefully inspect concrete structures for cracks or the loss of watertight seals. Also check the walls of the earthen waste storage pits to be certain that liner materials have not been eroded by pit agitation or wave action.

Freezing and thawing, as well as wetting and drying, may cause the sidewalls of earthen pits/lagoons to crack, allowing wastes to seep into the subsurface soil. Earthworm channels can allow water to move through the sidewall/liner. Groundwater contamination will result if the subsurface soil does not have sufficient ability to filter the contaminants contained in the leachate.

While seepage from inground waste storage facilities is not always easy to recognize, there are some telltale signs:

- A properly designed structure has the capacity to handle wastes from a specific number of animals for a known number of days. **For example, if a pit designed for 180 days of storage has received designated waste amounts and has not needed pumping for a year, the pit is probably leaking.**
- Evaporation from liquid storage pits is minimal, particularly with waste from dairy cattle, which forms a crust when it is stored. **If additional liquids have to be added before the pit can be agitated and pumped, it may be leaking.** (Monitoring wells installed upslope and downslope from the storage pit would be required to confirm the seepage.)

Some facilities for storage of solid or semi-solid manure are designed to allow seepage from the waste manure stack/pile. In these instances, the design of the structure (stack pad) must include a holding facility (pit/lagoon) for the waste liquids that seep out. Devices such as picket dams can be used to hold back solids and allow liquids to run off to a liquid storage pit/lagoon or a grass filter strip. This stack pad should have a roof to avoid having rainwater fall onto the manure stack. Divert upgradient clean water away from the manure stack.

Grass filter strips are thick, healthy stands of vegetation which allow runoff to seep into the soil and use nutrients in the water. With grass filter strips, it is important to ensure that the highly concentrated wastes do not "burn" the vegetation in the filter strip. Prevent clean water runoff from entering the filter strip. The best way to handle liquid waste is to channel it into a watertight holding pond or storage tank.

SHORT-TERM STORAGE

Short-term storage (usually 30 to 90 days) is an important option available to farmers.

It allows them to hold livestock wastes during periods of bad weather when daily 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 daily hauling and spreading of manure without the threat of runoff.

Short-term storage, which is restricted primarily to solid manure, has the disadvantage of requiring that the manure be handled twice. Designs are available for short-term storage structures that facilitate handling and provide effective protection for surface and groundwater.

Farmers, however, often find themselves stacking manure in fields, particularly during periods of bad weather; this practice is not recommended. No matter how it is done, manure stacking/piling poses a contamination threat to surface water and groundwater. If manure is frequently stacked in fields, it might be appropriate to consider constructing a short-term storage facility.

Likewise, many farmers scrape waste into piles in the barnyard rather than haul it during bad weather or busy work periods. This practice is not recommended either, because of possible herd health problems and water quality problems. The severity of these problems depends on the characteristics of both the barnyard area where the manure is piled and the area to which runoff flows.

As mentioned above, a stack pad can be used to temporarily store manure next to the livestock yard. This allows farmers to scrape manure off the yard onto the nearby stack pad. The stack pad keeps animals away from the manure, temporarily stores the manure, and allows liquids to seep to a pit/lagoon or grass filter strip. The stack pad should have a concrete surface, roof, and wood or concrete sides which allow the liquids to seep to the pit/lagoon or grass filter strip. Solids should be removed from the stack pad as needed and spread on crop fields at a recommended rate.

Many farmers have open housing for young stock, such as pole sheds, where wastes are allowed 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 the floors are concrete, and if they are protected from surface water runoff. To minimize water quality impacts, provide adequate bedding and clean livestock sheds as frequently as possible. Stack pads may be built near open housing structures so manure can be scraped from the open housing to the stack pad as needed.

WASTE STORAGE LOCATION

The location of livestock waste storage in relation to any well, spring, sinkhole, or other water resource (stream, pond, etc.) is an important factor in protecting the groundwater. For temporary manure stacks (on soil) and earthen storage pits/lagoons, the recommended separation distance is 250 feet. **Kentucky regulations (401 KAR 6:310) prohibit the stacking of manure on soil within 75 feet of a well.** For liquid-tight (concrete with no cracks) manure storage structures, the recommended separation distance is 100 feet. Locating animal waste storage facilities downslope from any well, spring,

sinkhole, or other water resource is also important for protection of the groundwater.

Observing these site criteria for minimum separation distances is a good way to help protect the groundwater that may supply your drinking water, but separation is not enough to protect the groundwater that may serve as another family's drinking water. Livestock waste storage structures that are poorly designed or poorly maintained could contaminate the groundwater no matter how far they are from any well, spring, sinkhole, or other water resource. Protecting the groundwater resources as a whole can help to protect the groundwater that serves as your drinking water as well as drinking water for others.

(For more information about separation distance and how the condition of your well might affect the potential for contamination, see the KY•A•Syst publication Assessing and Reducing the Risk of Groundwater Contamination from Drinking Water Well Condition*.)*

OTHER MANAGEMENT FACTORS

Anyone who plans to construct or install a manure handling system for a confined feeding operation needs to obtain a permit from the Kentucky Division of Water. Contact your regional Kentucky Division of Water office for details about this permitting process. Call or write the Kentucky Division of Water in Frankfort (18 Reilly Rd., Frankfort, KY, 40601; 502-564-3401) for the location of your regional office.

Kentucky Division of Water inspectors have the right to levy fines if animal waste is found to degrade a stream or any other "waters of the commonwealth." Contact your regional Division of Water office for information about state regulations regarding the handling of animal waste.

ABANDONED FEEDLOTS AND WASTE STORAGE STRUCTURES

Abandoned feedlots and waste storage structures, especially earthen waste storage structures, can pose significant water quality problems. Any abandoned feedlot or waste storage structure should be cleaned or completely emptied. Remove the top foot of soil in feedlots and the top two feet of liner materials from earthen waste storage facilities and spread it over croplands, just like manure. The remaining hole should also be filled and seeded with vegetative cover. If manure is stacked in fields, it should be removed as soon as conditions permit.

DEAD ANIMAL DISPOSAL

Improper disposal of dead animals can be a health threat to other animals and man, as well as a threat to both surface and groundwater quality. Optimally, dead animals should be brought to or picked up by a rendering company. In some counties a rendering company will provide free pickup of dead animals. In other areas, the animals must be brought to the company. Contact your local Soil Conservation Service office to find out if this service is offered in your county or the location of the nearest rendering company.

Composting is a proven safe method of disposing of poultry carcasses, and it shows promise for other animals. Contact your county Extension agent for information regarding the proper method for composting poultry carcasses.

Incineration of dead animals will also protect water quality, but presents air quality concerns and is therefore not as desirable as rendering or composting. The Kentucky Division of Air Quality discourages the burning of dead animals, although it may be the only alternative in some situations.

Burial in a hole or specially designed pit is a less recommended method of dead animal disposal. Burial presents a risk to both surface and groundwater. Composting and incineration are preferable for on-site disposal because they speed up the degradation of the dead animal and thereby protect water resources.

Dead animals that are buried for disposal should be buried as far as possible from any well, spring, sinkhole, or stream. Burial should be in a well-aerated soil (doesn't stay saturated or flooded) to enhance the degradation process. Kentucky regulations (KRS 257.160) state that animals that are buried must be buried "in the earth at a point which is never covered with the overflow of ponds or streams and which is not less than one hundred feet distant from any watercourse, well, spring, public highway, residence, or stable. The carcass should be placed in an opening in the earth at least four feet deep, the abdominal and thoracic cavities opened wide their entire length with a sharp instrument, and the entire carcass covered with two inches of quicklime and at least three feet of earth." Regulations also state that the animal must be disposed of within 48 hours after the carcass is found.

A FEW WORDS ABOUT YOUR SITE

The way home or farmstead practices such as livestock waste storage affect the groundwater depends in part on the type of soil and bedrock that is on your property.

How do soils affect the potential for groundwater contamination?

Soil characteristics are important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. In general, the

soil on your property may act as a filter that prevents contaminants from reaching the groundwater. Different soils have different abilities to "filter" contaminants. Areas with soils that let water flow through them quickly have a greater risk of groundwater contamination. This is because the soil doesn't get a long enough chance to absorb or "grip" the contaminant, and it may flow to the groundwater with leaching rainwater. On the other hand, soils that allow water to flow through slowly will do a better job of protecting the groundwater, but pose a higher risk of contaminating streams because the water will run off and may carry pollutants with it.

Sandy soils have large spaces between individual particles and therefore let water pass through quickly. Contaminants from your property can flow with this water. Because of this, sandy soils have a greater potential to pollute groundwater than clays.

Clay soils, on the other hand, have smaller spaces between individual particles, and therefore water passes through slowly. Slower-moving water allows contaminants a greater chance to be absorbed by or "grip" onto the soil. Because of this, clays do a better job of protecting the groundwater. Since water moves through a clay soil slowly, there is a higher chance of runoff. This can result in surface water (stream) contamination. In other words, there is a tradeoff between groundwater and surface water protection. If your site has a clay soil, it will do a better job of protecting the groundwater, but you must also look out for surface water contamination.

In Kentucky, the type of bedrock on your property is more important than the type of soil in determining your site's ability to protect the groundwater.

How does the bedrock on your site affect the potential for groundwater contamination?

Bedrock is the rock that lies underneath the soil on your property. Like the soil, different types of bedrock have different abilities to protect (or not protect) the groundwater from pollution. Knowing the bedrock which underlies your property is therefore important because it can tell you if you live in an area that is sensitive to groundwater contamination. Many areas of Kentucky have large springs, sinkholes, caves, and "disappearing" or "losing" streams. These areas are called karst and are especially sensitive to groundwater contamination. This is because the bedrock is dissolved by water, and large conduits and caves are formed underground. These conduits and caves allow pollution to flow very quickly from the surface to the groundwater. Basically, karst areas may act like a sewer system that connects your home or farmstead to the groundwater. Look at the map at the end of this publication to see if you live in a region of the state which has a low, medium, high, or very high sensitivity of groundwater contamination. If you live in an area which has a high or very high sensitivity (karst areas), you need to be especially careful with how you manage your home or farmstead pollution sources. This means being very careful around sinkholes and water resources (wells, springs, streams, etc.). **Do not dump garbage into sinkholes, or you will contaminate the groundwater that serves as drinking water for many families.**

Potential effects of underground mining

Underground coal mining done underneath or near your property may result in the subsidence, or settling, of your property. This settling may cause damage to structures as well as put groundwater at risk of being contaminated. The settling causes cracks in the land that can then allow pollution from the soil surface to enter the groundwater. The chance of subsidence occurring on your property depends on when the underground mining occurred, the depth of the mine, and what type of mining was done.

Depending on the type of underground mining done, different precautions are taken by mining companies to prevent subsidence. "Room and pillar" mining leaves pillars in the mines that support the land above when the mine is abandoned. As time passes, there is a greater risk that these pillars can degrade and result in the subsidence, or settling, of the land above. Certain types of "longwall" mines do not provide pillars. Therefore, these mines have a greater chance of resulting in subsidence. The depth of the mining also affects the chance that subsidence will occur. Deeper mines (greater than 400 feet) are less likely to cause subsidence than shallow mines (less than 200 feet). Information regarding the type and depth of underground coal mines may be obtained from the Department of Mines and Minerals at 606-254-0367 (ask for the Map Room). Be prepared to describe the location of your property in as much detail as possible (use a topographical map if possible).

CONTACTS AND REFERENCES
Who to call about...

Livestock waste storage, designing appropriate structures
County Soil Conservation
Service office . . . . . .check local listing
County Extension agent . . . . . .check local listing
Univ. of Ky., Dept. of Ag. Engineering . . . . . .(606) 257-3000
(Dr. Joe Taraba) . . . . . (ext. 216)
Univ. of Ky., Dept. of Agronomy . . . . . .(606) 257-4633
(Dr. Bill Thom)

Poultry waste management
County Soil Conservation
Service office . . . . . .check local listing
County Extension agent . . . . . .check local listing
Univ. of Ky., Dept. of Animal Sciences . . . . . .(606) 257-7529
(Dr. Tony Pescatore)

Cost share information
County Agriculture Stabilization and
Conservation Service office . . . . . .check local listing
County Soil Conservation
Service office . . . . . .check local listing

What is KY•A•Syst?
KY•A•Syst is a series of publications which will help you assess *and improve* how effectively your home or farmstead practices protect the groundwater. The publications ask you about your home or farmstead structures and activities. Your answers will help you see how your practices might be affecting the groundwater. Each publication then gives suggestions about things you can do to improve your home or farmstead practices to better protect the groundwater.

The topics of the program include:
- Drinking Water Well Condition
- Agricultural Chemical Storage and Handling
- Petroleum Product Storage
- Household Waste Management
- Household Wastewater Treatment
- Livestock Waste Storage
- Livestock Yards Management
- Silage Storage
- Milking Center Wastewater Treatment

Some of these topics apply only to people who have farms, and others apply to both farm owners and non-farm owners. ***This program is a completely voluntary program: it is an assessment you can perform in the privacy of your own home. No information from the publications needs to leave your home. The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.***

Edited and compiled by Mark Dravillas, former Extension Associate for Water Quality, and Tom Ilvento, former Associate Extension Professor in Sociology, University of Kentucky Cooperative Extension Service. Based on materials from the National Farm•A•Syst Program, University of Wisconsin (author: David Kammel, University of Wisconsin, Madison). Special thanks to Bill Thom, Dept. of Agronomy, Glenn Mackie, Dept. of Agricultural Programs, and Tony Pescatore, Dept. of Animal Sciences, University of Kentucky, for technical review and comments.

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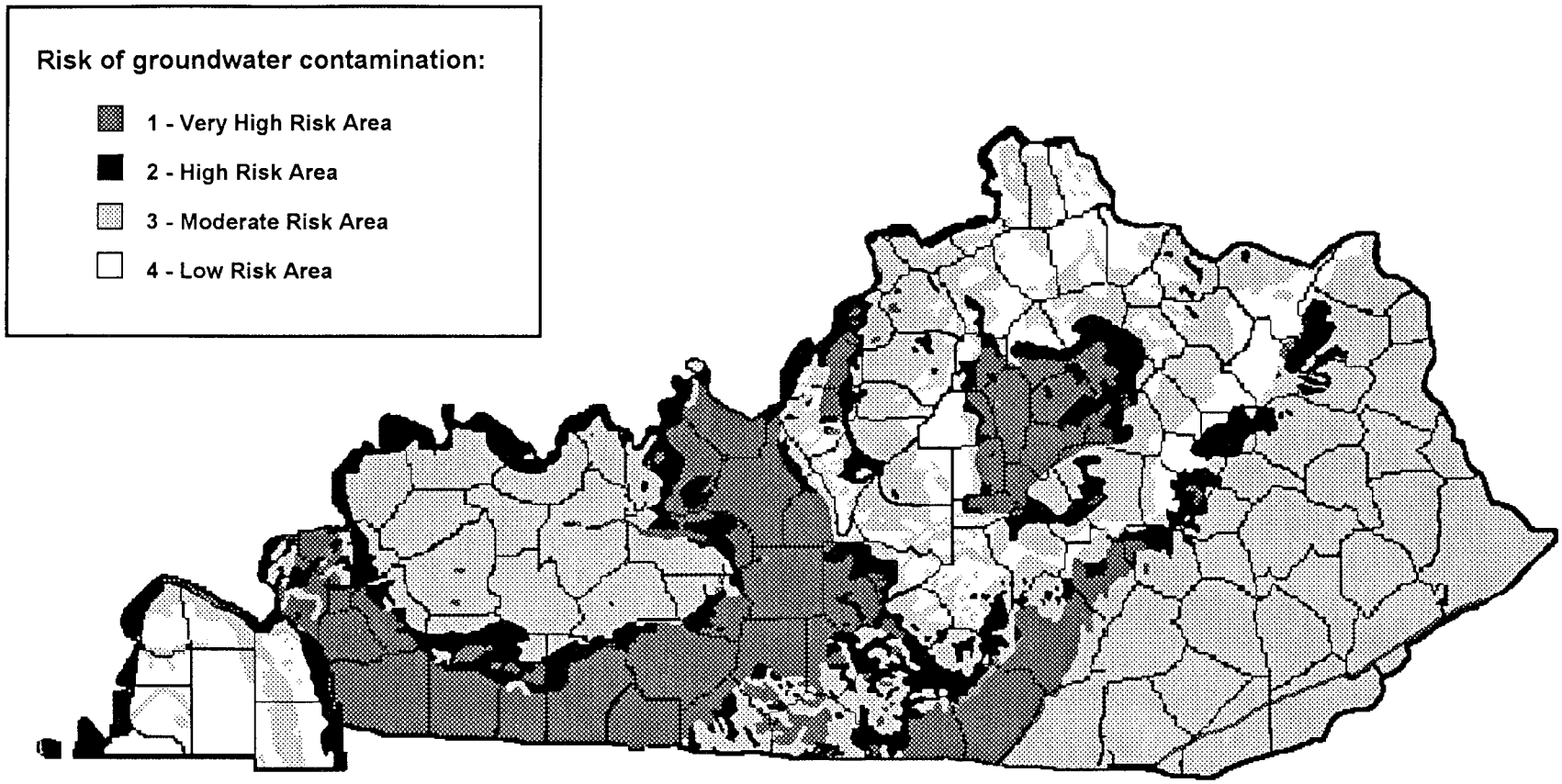
The KY•A•Syst project is coordinated by the Kentucky Cooperative Extension Service in collaboration with various Kentucky state and federal organizations and agricultural commodity and environmental groups.

KY•A•Syst publications can be obtained at your county Cooperative Extension Service office. For additional information on the KY•A•Syst program, contact Marla Barnett at (606) 257-2735 or Dr. Curtis W. Absher at (606) 257-1846.

Groundwater Sensitivity Map



Reproduced from a map created by Division of Water - Groundwater Branch : Frankfort, Ky.

This map shows the potential for groundwater contamination in the different areas of Kentucky. Find the county you live in to determine how sensitive your region is to groundwater contamination.