Sinkholes In Western Maryland

** Content on this webpage is taken directly from **A User's Guide to Karst and Sinkholes in Western Maryland** By Topper Sherwood, published by the Western Maryland Resource Conservation & Development Council, 2004 -- Please refer to this publication for further general information on sinkholes.*

WHAT IS KARST TOPOGRAPHY?

"Karst" describes terrain that's characterized by sinkholes, caves, underground streams, and other features that are formed by the slow dissolution of calcium and magnesium oxides in limestone, dolomite, or marble bedrock. Karst landscapes are often spectacularly scenic areas. Examples include the sinkhole plains and caves of central Kentucky, the large crystal-clear springs of Florida, and the complex, beautifully decorated caves of New Mexico. Karst terrains are areas of abundant water supplies, limestone quarries, and minerals. In the United States, 20 percent of the land surface is karst and 40 percent of the groundwater used for drinking comes from karst aquifers.

People who settle in karst areas, however, can find themselves dealing with associated problems. Karst regions can be prone to unpredictable or easily contaminated groundwater supplies or unusual surface water drainage. Karst landscapes are also among the most susceptible to environmental impact, including ground subsidence. Following storms, droughts, and changes in land use, sudden subsidence features known as sinkholes, can cause damage to buildings, roads, parking lots, and farmed land.

In unpopulated and undeveloped areas, a sinkhole may pose little or no danger. In populated and developed regions, however, sinkholes are more likely to cause problems. They present us with two kinds of hazard: 1) the physical danger of falling into them, as well as the danger to structures — buildings, roads, airport runways, etc.; and 2) the threat to ground and surface water quality by the potential for direct introduction of contaminants. People living and working in karst regions need to be particularly sensitive to issues of land use and water quality protection.

The stakes are high for communities confronting the physical danger of sinkholes. Recent collapses have been occurring along Interstate 70, in Frederick County, and one sinkhole that opened suddenly on a state highway in Carroll County in 1994 caused a fatal auto accident there. Sinkholes appearing in fields have injured livestock and damaged farm equipment. The threat to water quality is well documented and can pose a significant and quick hazard. Stream water or surface runoff that enters a sinkhole or cave can bypass natural filtration

through soil and sediment. Groundwater can travel quite quickly through these underground networks —up to thousands of feet per day — carrying surface contaminants to wells and springs.

MYTHS & FACTS ABOUT KARST AND SINKHOLES

MYTH: Putting things down a sinkhole won't bother anyone. "Out of sight, out of mind."
FACT: Contrary to the "out of sight, out of mind" approach, we should consider sinkholes in terms of Karst's 'Reverse' Law of Gravity: "What goes down, eventually returns."

MYTH: Seal or cover the sinkhole — say, with dirt, rocks, or asphalt — and it will go away.
FACT: Covering or "plugging" the sinkhole, without paying attention to the subsequent movement of water, can give a false sense of security.

MYTH: If you leave a sinkhole alone, it will eventually take care of itself.
FACT: Sinkholes are a natural phenomenon, but we can't always ignore them — especially in populated areas. Nothing is simple. We have to examine sinkholes and, on a case by case basis, determine what should be done.

MYTH: All sinkholes imply natural void spaces or caves.
FACT: Actually, every depression in the ground — or even a hole — isn't necessarily a sinkhole. Such a hole could be caused by excavation for utilities, an old trash dump, or an abandoned well. It could be a "pseudo-sinkhole." How do the experts assess such 'artificial sinks?' For starters, they examine a hole's: 1) shape; 2) location; and 3) land use history. They also consult geologic or soils maps to see if limestones, dolostones, or marble exist in the area. (See MGS maps and reports for more information) Consider the shape of a depression or hole. Is it open or closed? Round or rectangular? Genuine sinkholes often start as depressions and open as funnelshaped pits, depending on terrain. A closed, rectangular depression may suggest a collapsed trench or buried object, like an old brush pile or settling trash dump. What about location? What do you know of the history of the site? Does it suggest a refuse pit, abandoned well or cistern, a submerged tank, or a utility trench? In some western counties, terrain is shaped by collapsed mine tunnels. One often brings questions like these to the examination of ground depressions and apparent sinkholes.

MARYLAND'S KARST AND SINKHOLES

Where are Maryland's karst areas?

The most-affected counties are Washington, Carroll, Frederick, and Baltimore, with less extensive areas in Allegany County. (See Figure 1. below) While we cannot know every detail of what lies in the ground below every piece of property, geologic mapping by the Maryland Geological Survey (MGS) has provided an excellent understanding of Maryland's subsurface. See MGS maps and reports for further information.

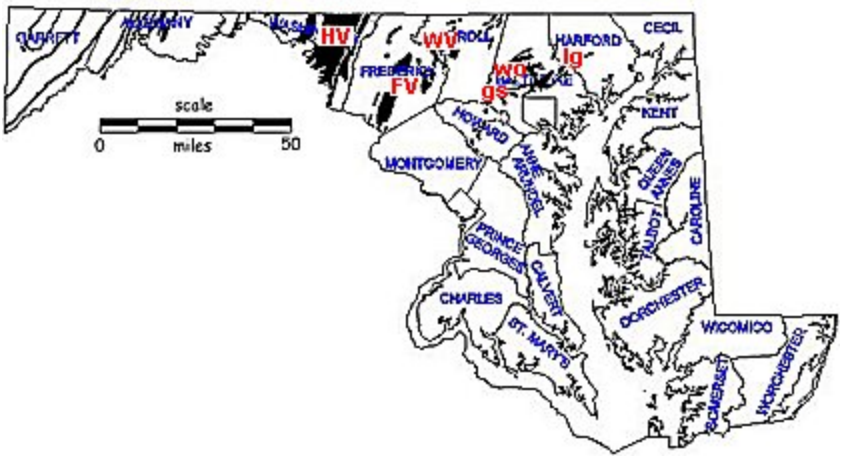

FIGURE 1. Map showing the distribution of carbonate rocks in Maryland. Those most associated with collapse sinkholes are the Hagerstown Valley (HV), the Frederick Valley (FV), and the Wakefield Valley (WV). To a lesser degree, collapse sinkholes are found in Green Spring Valley (gs), Worthington Valley (wo), and Long Green Valley (lg).

Soil surveys conducted by the National Cooperative Soil Survey also provide clues to potential areas of sinkhole development. Soil maps identify areas where soils originate from or overlie limestone and other material with some potential for developing sinkholes. To access soil survey maps and interpretive information, visit https://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=MD and navigate to a particular county. [The current Frederick County Soil Survey (2002) contains a soil interpretation table outlining the relative potential for sinkhole formation by soil series.]

MGS staff members estimate that Frederick County alone contains a vulnerable karst topography covering about 35 square miles. Washington County is estimated to have a karst area of two or three times that size. The Geological Survey has identified more than 1,000 “karst features,” including 125 sinkholes, in a relatively small portion of Frederick County. From this, we know that hundreds of sinkholes are likely to exist in each of the three mostaffected counties, Washington, Frederick, and Carroll.

Karst, Land Use, and Water Quality

All uses of land affect an area’s groundwater. Those of us who live and work in karst country, however — homeowners, real-estate professionals, public planners, farmers, or contractors — should be especially aware of the terrain’s tendency to form sinkholes and the implications for our water resources. Most karst areas are underlain by limestone which may be composed of varying degrees of openings. Sometimes large, sometimes small most have the ability to transmit water and soil. Sinkholes occur when a “bridge” of loose stones and soil collapses into a fissure or opening in the rock, sending surface material and water into underground cavities (see Figure 2). Such sinkhole collapses occur naturally; they also may be prompted

by human activity. Examples would be ponding water, extracting groundwater for water supply or quarrying, blasting, grading or soil disturbance.

Some common features that may warn of eventual sinkhole collapse include:

- Circular and linear cracks in soil, asphalt, and concrete paving or floors;
- Depressions in soil or pavement that commonly result in the ponding of water;
- Slumping, sagging, or tilting of trees, roads, rails, fences, pipes, poles, sign boards or other structures;
- Downward movement of small diameter vertical structures such as poles or posts;
- Fractures in foundations and walls, often accompanied by jammed doors or windows;
- Small conical holes appearing on the surface of the ground during a relatively short period of time;
- Sudden muddying of water in a well that has been producing clear water; or
- Sudden draining of a pond or creek.

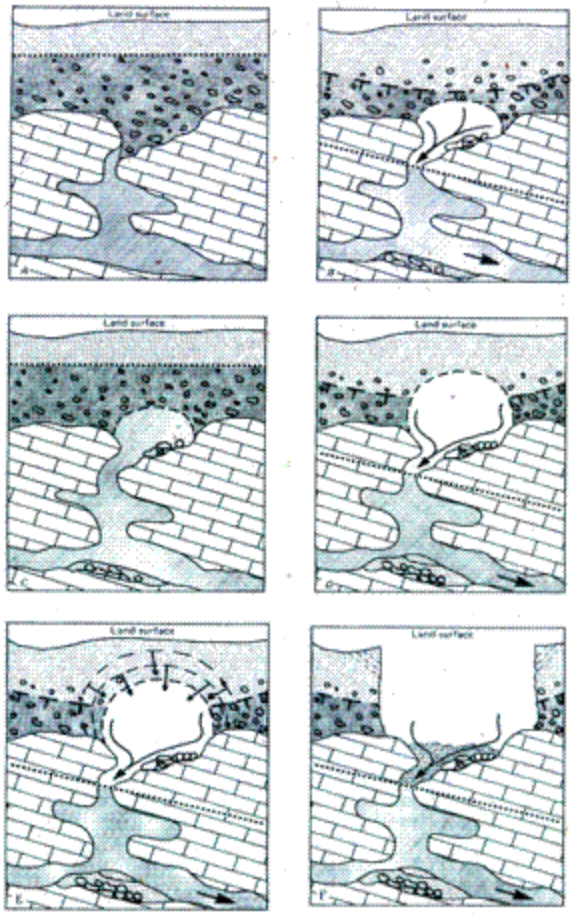

FIGURE 2. Sinkhole formation.

An open sinkhole—as big as a house, or as small as a coffee mug—may carry untreated surface water, directly and immediately, to local aquifers affecting any number of springs, and well sources. Sinkholes may threaten water quality, for example, when they occur near underground water and sewage systems. Karst-area water resources and wells have been damaged by cracked sewer lines, and drain fields placed where natural soil filtration can be bypassed. There have been accidental or inadvertent discharges from gas stations, treatment plants, and other facilities with underground storage tanks and associated piping causing materials to leach into and move quickly through the karst subsurface, polluting local water supplies. In the worst cases, sinkholes have been used as dumping grounds for old appliances, tires, car batteries, household garbage, agrochemical containers, and dead animals.

Runoff, spills, or pesticides and fertilizers from lawns and farms can leach through the many spaces in the rock, unfiltered by the soil, enter the groundwater system, and lead into water sources. Thousands of residents in our region get their water from home wells; and hundreds of new wells and septic systems are installed here each year. Problems already have occurred.

Residents of Frederick County recall when one small town's entire water system had to be shut down for nine months, after a broken sewage line sent polluted water directly into the karst aquifer that supplied the town's water system.

Drinking water sources "were polluted almost as soon as the leak was discovered," one soil conservationist observed.

Surface runoff carrying contaminants can also pose danger to underground biological life. Cave-dwelling organisms thrive in underground cracks and crevices, in relatively dry environments and underwater. Understanding these organisms and their habitats requires that we learn more about karst and prevent surface contamination where we can.

PROBLEM: RUNOFF

Runoff refers to the water from rain or melted snow that does not infiltrate the soil but flows over the land surface as drainage. This is the water that flows, for example, from streets and parking lots. Such water may be directed to constructed ponds or other stormwater management structures or, untreated, through storm drains into rivers and streams.

Runoff can carry motor oil, antifreeze, salt, sand, litter, pet waste, fertilizer, yard and garden debris, and consumer chemicals that have been dumped on the ground. In one study, by the Environmental Protection Agency (EPA), some of the most toxic samples of runoff were collected from residential roofs, carrying such pollutants as bird droppings, roofing-material chemicals, and heavy metals leached from gutters. In karst areas, sinkholes act very much like storm drains, carrying runoff into fissures and caves, ultimately discharging into rivers, streams, lakes — or into wells, springs and other local sources of drinking water.

Studies show that sinkhole development can be reduced by dispersing water runoff, allowing it to infiltrate the ground over a wide area, as opposed to concentrating it in ditches and swales. Developers attend to the special needs of karst areas, for example, by designing and constructing driveways and parking lots which disperse, rather than concentrate, rainwater runoff. This allows the water that would otherwise be directed into drainage ditches and culverts to be dispersed around the perimeter of the paved area.

Some county officials in Maryland's karst areas have considered special karst-sensitive water-management practices and specifications. Such policies have been passed by local governments in other states. County and local governments in other states have legislated special watermanagement practices for industrial or commercial sites located in karst areas.

What You Can Do:

- Never dump anything onto a parking lot, into a storm drain, or down a sinkhole.
- Divert water run-off away from sinkholes.
- Recycle motor oil at a local gas station or recycling center.
- Use fertilizers wisely. Have soils tested to determine proper amounts.

- Keep pesticide use to a minimum. Use least-toxic alternatives.
- Maintain vegetation on steep slopes to keep soil in place.
- Compost yard and garden debris.
- Do not overfill car radiators and fix leaks.
- Move down spouts from roof gutters so water discharges onto grassy areas, away from your foundation and septic system. This allows runoff to filter into the soil, where harmful pollutants are broken down by soil organisms.
- Sinkholes that receive runoff should be remediated as soon as possible.
- Find and use the best practices for dispersed stormwater management in karst areas.

For Additional information:

- download this publication - A User's Guide to Karst and Sinkholes in Western Maryland By Topper Sherwood, published by the Western Maryland Resource Conservation & Development Council, 2004 (pdf, 1 Mb)
- What to do if you suspect a sinkhole