

Updated 10-18-2015

# HYDROLOGIC ATLAS OF THE BLACK HILLS, PENNINGTON COUNTY, SOUTH DAKOTA HILL CITY QUADRANGLE

## Aquifer Vulnerability Map

### ***Aquifer Vulnerability:***

Basically, vulnerability "...is the tendency or likelihood that pollutants may reach the water supply" (Hargrave, 2005) and includes human influences in the introduction of pollutants into aquifers. See the lower left corner of the aquifer vulnerability maps for information regarding the rating system used here.

### **Precambrian aquifer (undifferentiated):**

Ground water in the area of the Hill City quadrangle is contained either in fractured Precambrian crystalline rocks (Figure 1), e.g., schist, quartzite and metabasalt, or in shallow sand and gravel deposits along streams.

The amount of water available from the Precambrian rocks in any selected area is the result of the number of such fractures and the size of the openings produced by them. Any preferred trends or inclinations of fractures may result in a preferred movement direction of the ground water: such features must be determined on a site-by-site basis.



Figure 1. Parallel fractures in metagraywacke in the east side of Hill City. Orange, rusty color indicates movement of groundwater along fractures.

Due to the complexities noted above, a quantitative method for determining *aquifer susceptibility* (ability of the rock to hold water) within crystalline rocks has not been established

or chosen by our group. As a result, the following discussion of *aquifer vulnerability* represents a qualitative assessment based upon factors considered as having the potential to affect the quality of ground water in the area.

### ***Septic Systems:***

Urbanization and growth in the number of home sites and, therefore, on-site waste water treatment facilities within the area has undergone a marked increase in the past 20 years. This has been made possible, within the Black Hills National Forest, the presence of numerous patented mining claims and homesteads there. For example, the U.S. Geological Survey 7.5 minute Hill City topographic quadrangle map, published in 1977 shows approximately 160 home sites outside of the town of Hill City. In 2011, based upon areal photographic analysis, this number had increased to 572 in an area of approximately 18 square miles (an average of 95 per square mile).

Aquifer vulnerability, as shown on the vulnerability map, varies by location and the type of risk factor. Large areas within the National Forest (approximately 31 square miles) are undeveloped and are assigned a rating of **low** vulnerability.

Areas of potential concern are those in which home-site concentrations are greater than 40 sites per square mile (see map). These areas (a total of approximately five square miles) are assigned a **high** vulnerability rating.

### ***Roads***

One hundred meter (330 feet)-wide buffer zones along roads are assigned values ranging from **low**, on dirt roads with lesser traffic, to **high** along paved road on the flood plain deposits along creeks. Vehicles, e.g., gasoline and propane trucks, and others carrying chemicals, travel U.S. Highway 16 and, to a lesser extent, Highway 244 both which follow valley bottoms for extensive distances. Any substances released from such tanks (fortunately none were in the example shown in Figure 2—photo from the Rapid City Journal), or from vehicles themselves, have the potential to contaminate ground water in the underlying aquifer.

### ***Agricultural uses***

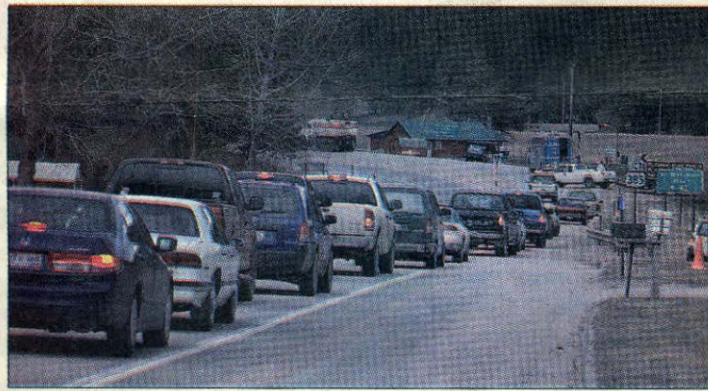
Grazing of cattle occurs on some portions of the recharge area, but major feed lots, etc. are lacking. Farms, which might apply chemicals, are not currently active within the recharge area.

## **References**

Hargrave, R. G, 2005, Vulnerability of the Minnelusa Aquifer to Contamination in the Rapid City West Quadrangle, Pennington County, South Dakota: unpub. M. S. thesis, South Dakota School of Mines and Technology, 80 p.



Photos by Dick Kettlewell/Journal staff



A tractor-trailer loaded with 9,000 gallons of propane overturned at the corner of U.S. Highways 16 and 385 on Saturday afternoon. The driver was taken to the hospital, but his injuries are not believed to be serious. After the tanker overturned, law enforcement closed the intersection. Traffic backed up for a quarter of a mile at one point.

Figure 2. Accident at the intersection of U.S. Highways 16 and 385 involving a propane delivery truck. This occurred along the flood plain of the nearby Spring Creek.