Binnewater Karst Aquifers: Groundwater Flow Route Assessment Via Tracer Testing

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Karst Aquifers.

Binnewater karst aquifers lie at the northern terminus of the Shawangunk Mountains in the towns of Rosendale and Hurley, NYS. Karst is a term used to describe a landscape in which the landforms are produced mainly by dissolution of bedrock, most typically limestone and dolostone. The most important criterion for identifying a karst area is the way groundwater behaves.

Binnewater Cave: 2m high
Formed in Becraft limestone

Water in karst areas drains underground through solution conduits. Water in solution conduits can travel up to several kilometers per day, and contaminants can move at the same rate with little or no natural cleansing. Sound land use planning in karst terrains requires protection of both groundwater and receptor water quality (e.g., streams, wetlands, springs, wells, bat hibernacula). This is accomplished using tracer tests to resolve groundwater flow paths down gradient of stream, lake, mine, and sinkhole insurgence points.

Cave insurgence on 4th Lake: 1m high

Aquifer Details.

All of Fourth Lake is pirated into Helderberg Group carbonates

The Greenkill Springs appear to drain much of the Binnewater karst area. Low discharge gaged on February 15 & 17, 2010: ~7 cfs

Groundwater flow in Binnewater karst aquifers is influenced by a combination of bedrock lithology and structure, topography, glacial processes, and stream incision. The aquifer area lies within the complexly folded and faulted Hudson Valley fold-thrust belt. Here, deformation of rigid sedimentary strata, sandwiched between thick, relatively ductile, shale units is expressed in low to steeply dipping, repeated, thinning, ramped, and truncated beds. The complex structure of numerous synclinoria and anticlinoria can readily be inferred by viewing the Becraft Limestone map pattern or by reviewing Burmeister's 2003 and Marshak's 1990 geologic maps. The resulting bedrock structure is analogous to that in the Appalachian Valley-and-Ridge Province of the southeastern US where steeply upturned beds orient karstic groundwater flow along bedrock strike - often sandwiched between non-carbonate units. For example, Binnewater Cave trends along strike (N21° E) in beds dipping 67° NW. Two cave-bearing carbonate units support karstic groundwater flow: the Becraft Limestone and Helderberg Group formations (Rondout, Manlius, Coeymans). Shaly limestones (Dkn: Kalkberg, New Scotland) separate karstic Binnewater carbonate units. Karstic groundwater flow stemming from planned HRVR development may discharge partially to the SSW near the Rondout Creek and partially to the NNE, east of Third Lake. Geologically, these are the most likely resurgence areas. A groundwater divide may occur between Fifth and Fourth Lakes. Numerous, large, room-and-pillar cement mines disrupt and integrate karst aquifers, as does glacially sculpted Fourth Lake. Many mine and Binnewater cave locations are not plotted on the color GIS map.

Tracer Testing.

Characterization of conduit portions of karst aquifers requires delineation via tracer tests. They are used to determine groundwater flow direction, velocity, and destination, as well as to assess contaminant risks. Evaluation of the planned Williams Lake development must assess risk to both surface and groundwater resources. The results of spring reconnaissance work to date are portrayed on the reverse side map. Spring locations are controlled by bedrock structure. Interestingly, springs situated north and above the Rondout Creek are underfit relative to the quantity of water that is pirated underground from Fourth Lake. This water, as well as the pirated water of Third Lake, may resurge as the Greenkill. Its large volume may formerly have provided water for the historic White's and DeWitt mills. Tracer testing is needed.

Greenkill flow may, in large part, represent the resurgence of Fourth Lake

Honey Spring flow increases with large runoff events

Map Date: 3-01-10