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Pennsylvania Council of Professional Geologists
116 Forest Drive • Camp Hill, PA 17011
Phone (717) 730-9745 • pcpg.org

Hydrostructural Methods in Bedrock Aquifer Characterization and Remedial Decision Making

March 29, 2022
Coatesville, PA

As in all groundwater systems, gravity-driven flow through bedrock formations occurs within a single integrated hydrologic potential field in which every particle of groundwater residing in connected pore spaces below the phreatic surface is affected by, and contributes to, the overall field potential. Flow in most bedrock aquifers occurs through a three-dimensional network of saturated, hydraulically connected planar discontinuities which typically occur in multiple, pervasive, non-randomly oriented sets, each set being possessed of a unique, statistically averaged, orientation. Therefore, bedrock formations generally contain discontinuities at several predominant strike directions, typically none of which are parallel to the groundwater flow vector. Consequently, groundwater flow along a field hydraulic gradient is sub-parallel to the strikes of all planes, providing for three-dimensional flow as dictated by the flow field.

Combining a refresher on the concepts and methods of structural geology with quantitative analysis of gravity-driven groundwater flow within and between discrete, connected, planar flow pathways, this full day, hands-on course provides the tools of both visualization and quantification of flow in three-dimensional space. Including a complete review of the methods of planar structural analysis, the course explores: the control of geologic structure on groundwater flow within individual fractures; anisotropic responses to aquifer testing and a comparison to field anisotropy; structurally-controlled deflection of tracers and/or contaminant plumes; the effects of the scale of observation on aquifer heterogeneity and anisotropy; migration of separate phase liquids and gases; the hydrologic effects of fault systems; groundwater flow within structural domains of differing, yet overlapping, scales of observation.

Level: Advanced

Proposed Agenda

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| 8:00-8:30 | Arrivals, Registration & Morning Refreshments |
| 8:30 | Overview of modeling flow in fractured media, introduction to hydrostructural geology and practical applications |
| | Structural planes, right sections, apparent dips, stratigraphic thickness, one-point problems, three-dimensional projections-problem solving session No. 1 |
| | Three-point problems, structural contours-problem solving session No. 2 |
| 10:15-10:30 | Break |
| 10:30 | Structure and topography, outcrop patterns, subsurface projections, problem solving session No. 3 |

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12:00-12:45 Group Luncheon

12:45 Faults, fault motion, fault solutions, planar discontinuities in rock masses, characterization, spatial and orientational distribution, statistical analysis, structural data plotting. Problem solving session No. 4.
Hydro-Structural Geology; Structural controls on groundwater flow. Flow in planar discontinuities, structurally-controlled anisotropy, approximations and porous medium equivalents

2:30-2:45 Break

2:45 Hydro-Structural Geology - Application of structural geology to groundwater flow and contaminant transport. Immiscible, separate phase liquid migration. Problem solving session No. 5
Hydro-Structural modeling, structural controls on contaminant dispersion and distribution, modeled prediction of transport anisotropy.

4:30 Adjournment / Evaluations / Sign-Out / Pick-Up Certificate of Attendance

About Our Presenter

Thomas D. Gillespie, P.G., Senior Professional Geologist (Gilmore & Associates) – licensed professional geologist with 37 years' experience in groundwater, water resource management, engineering geology, geologic hazard assessments, environmental risk management, stormwater, mining, oil & gas exploration, site remediation. Expert hydrogeologic witness in all experience sectors at all levels of the Court System.

Two consecutive six-year terms on the Pennsylvania State Registration Board for Professional Engineers, Land Surveyors and Geologists; two terms as President of that Board. National Association of State Boards of Geology, subject matter expert in structural geology, hydrogeology and engineering geology. Institutional expert consultant to the Department of the Army's Technical Assistance Team.

Adjunct professor of geology at The College of New Jersey, LaSalle University; continuing education instructor of structural geology and hydrostructural geology. Founding member of the Pennsylvania Council of Professional Geologists - Board of Directors, one term.

Current research in modeling groundwater flow through fractured media.