Sanborn Head offers considerable depth in characterization of fractured rock sites, a specialty area for the company. Our expertise has grown over decades of hydrogeologic and groundwater engineering practice in a wide range of geologic terrains across the U.S. and abroad. Our experience has been developed on projects associated with mining, landfill siting and closure, hydrocarbon release sites, chlorinated solvent sites, and development projects involving rock excavation and blasting, as well as bedrock water supply development.

We have established collaborative preferred business relationships with specialty laboratories, geophysical contractors, and monitoring technology vendors and universities to bring advanced suites of technologies to bear on projects. Our decades of professional experience at hundreds of sites, combined with advanced technologies, bring greater certainty and clarity to the management of risk associated with development or remediation of fractured bedrock sites.

Sanborn Head has conducted site specific programs of bench scale and field pilot studies to support feasibility studies and remedial alternatives analysis for fractured bedrock sites, including remedial technologies such as:

- Enhanced Biochemical Degradation
- In Situ Chemical Oxidation
- Thermally Enhanced Extraction
- Hydraulic Control
- In-Well Stripping/Circulation
- Monitored Natural Attenuation
Mixed Petroleum Hydrocarbons and Chlorinated Solvents in Upland Fractured Siltstone, New York State

Sanborn Head was one of the first U.S. consulting firms to use the Discrete Fracture Network (DFN) Approach (Parker, 2007) for remedial investigation/feasibility study (RI/FS) work in a fractured sedimentary rock setting. The RI found the primary source of on-going groundwater contamination to be VOC mass residing in the matrix of rock beneath about a 1.6 acre area, primarily within the upper 15 feet. The RI/FS evaluation included bench scale testing of thermal treatment, as well as field scale pilot testing of enhanced biochemical degradation.

Remedial Investigation of Chlorinated Solvents in Fractured Sandstone, Siltstone and Shale, Virginia

Sanborn Head completed an engineering evaluation of vapor and groundwater extraction and treatment operations to address a mile-long plume. Our services also include development and application of a three-dimensional numerical groundwater model to evaluate alternative hydraulic containment strategies, completion of field testing of groundwater extraction alternatives, and siting, construction, and testing of a new extraction well. We have also evaluated vapor intrusion potential in a downgradient residential area.

Supplemental Site Characterization and RCRA Corrective Measure Study, Chlorinated Solvent Release in Karst Limestone, Kentucky

Sanborn Head evaluated a dual-phase extraction remedy, and completed a bedrock investigation that included detailed core logging, groundwater pumping tests, and tracer testing in karst limestone, as well as a systematic assessment of in-situ biochemical degradation. On the basis of this work, we developed a remedy inclusive of monitored natural attenuation, hydraulic containment, and subslab vapor extraction.

Characterization of Bedrock Hydrogeologic Conditions in Support of Solid Waste Landfill Expansion, Vermont

Sanborn Head evaluated bedrock hydrogeologic conditions at an existing solid waste landfill to support the engineering design and permitting of a landfill expansion. The expansion entails extensive bedrock excavation in an area underlain by metamorphic bedrock formations comprised of highly-fractured schist and phyllite. Our services included fracture-trace analysis, field mapping of bedrock lithology and structure, installation of multi-level bedrock monitoring wells, and hydraulic testing. These services were supplemented by geophysical logging of selected bedrock boreholes, including optical and acoustical televiwer, acoustic caliper, fluid temperature and resistivity, and heat pulse flowmeter (HPFM) methods.