Schlumberger
WATER SERVICES

Remedial Investigation at a Superfund Site

Case Study: Multilevel Sampling and Monitoring, Maryland, USA

Challenges

Volatile Organic Compounds contaminated the groundwater posing a risk to nearby private water supply wells. The traditional approach of drilling and sampling multiple boreholes did not provide adequate data to characterize groundwater flow and contaminant migration in the complex fractured bedrock.

Solution

Westbay System* was installed in the bedrock formation and provided the ability to collect discrete samples from multiple levels in each borehole in order to quantify water quality and vertical hydraulic head distribution at the site.

Results

Contaminant concentrations are higher in low-yield fractures due to limited dilution. There is upward groundwater flow towards Little Elk Creek. Potentiometric levels in the deeper bedrock do not respond to precipitation. Groundwater elevations correlate to changes in barometric pressure. Improved understanding of the effects of depth on fracture frequency and aperture.

Background

Between 1962 and 1988 Galaxy Chemicals/Spectron, Inc. recycled chemical solvents and blended fuels at a site located just six miles off busy Interstate 95 in Elkton, Maryland, USA. In 1988, after nearby residents complained of careless practices at the plant, the State of Maryland shut Spectron down. The company declared bankruptcy and abandoned the site. Soon afterward, the U.S. Environmental Protection Agency (US EPA) placed the site on its National Priorities List. Remedial Investigation (RI) work has been taking place at the present-day Spectron Superfund site ever since.

During the time Galaxy occupied the site volatile organic compounds such as trichloroethene (TCE), perchloroethene (PCE), and 1,1,1-trichloroethane (TCA) contaminated the groundwater in the area.

For the purposes of the RI, the Spectron site was divided into two operable units: OU-1 (overburden soil) and OU-2 (bedrock groundwater). Of the two, OU-2 was more difficult to characterize. Because of the site's complex fractured-rock hydrogeology and the dense, non-aqueous nature of the site contaminants, a larger than usual amount of data was required to assess the extent of contamination and develop a Conceptual Site Model (CSM).

Drilling operations at the Galaxy Spectron site

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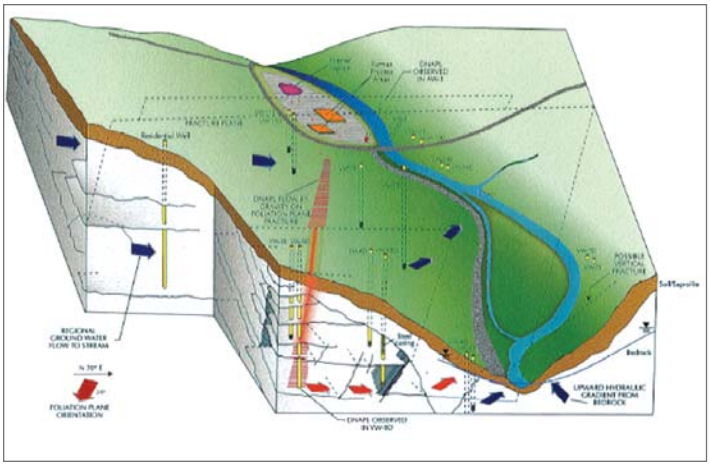
Solution

Remedial Investigation

The Spectron site, which is located along Little Elk Creek between two ridges, is characterized by a thin overburden of soil with fractured crystalline bedrock beneath. Nearby residences all have private water wells. Characterization of groundwater quality and flow in the bedrock was required to develop a detailed Conceptual Site Model (CSM) to be used to evaluate potential impacts to human health or the environment.



Bedrock Conceptual Site Model for Galaxy Spectron site

During early stages of the RI, when basic information on the nature and extent of contamination in the bedrock was being gathered, consultants used a traditional approach involving drilling and sampling of multiple monitoring boreholes to different depths. When it became clear that more detailed, discrete groundwater data were needed, Schlumberger Water Services's Westbay System was chosen. The proposed alternative approach was approved by the US EPA and work on the OU-2 RI has continued using Westbay System monitoring systems since 2006.

Results

Using the Westbay System, the following findings have been developed for the OU-2 RI:

- Bedrock fractures had formed primarily along the regional foliation plane
- Fracture frequency and aperture decrease with depth
- Yield and specific capacity of water-bearing fractures decrease with depth
- Significant hydraulic gradient, indicating groundwater flows upward toward the creek
- Potentiometric levels in the deeper bedrock do not respond to precipitation
- Bedrock groundwater elevations correlate to changes in barometric pressure
- Low-yield fractures had high concentrations of contamination due to limited dilution
- High-yield fracture zones had lower concentrations, due to greater groundwater movement through the fracture zones

Westbay System

The Westbay System offered an effective and less costly way to detail the distribution of hydraulic head in the bedrock and confirm the direction of groundwater flow, while also providing accurate water quality data to delineate the boundary of the contaminant plume. Further, the system was capable of gathering both types of data successfully and accurately over a long period of time. Remedial investigation work continues at the site.

Little Elk Creek after restoration

Differentiation Through Technology and Services

Schlumberger Water Services (SWS) provides a complete range of cost-effective water exploration, utilization and optimization solutions for public and private sectors. Working as an integral part of your team or as technology providers, we offer several scalable solutions to meet your business needs. With over two decades of environmental experience, our teams of professionals are ready to assist you in all aspects of your water and groundwater resource projects.

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