

Hydrocarbon Source and Fracture Characterization: The Conceptual Hydrogeological Model Framework for Making Informed Groundwater Remediation Decisions

Brent Lennox, Waterline Resources Inc.

Paradoxically, the first step to understanding the history of a site with impacted groundwater is “reading” the end of the story, which then helps to reveal the parts of the story with greater uncertainty: the beginning and middle. A case study will be discussed where the source of impacts in groundwater and its pathway from surface to the water table will be discussed in detail.

The site used as a case study is located in the Alberta foothills, with hydrocarbon impacts extending 100s of metres off-site in a sandstone aquifer. Potential sources of hydrocarbon impacts will be discussed based on available paper records, a shallow geophysical investigation (electrical resistivity tomography (ERT)), and hydrocarbon forensics of soil and groundwater. The pathway through the unsaturated, fractured sandstone from these potential sources will then be reviewed based on fracture orientation data collected using downhole camera and geophysical (optical televiewer) methods.

By understanding the beginning (i.e., source) and middle (pathway) of the story, the distribution of hydrocarbon impacts and strengths and weaknesses of remedial approaches were put into perspective. Remedial approaches taken at the site included a pump-and-treat system, source removal via remedial excavation, manual source removal, and monitoring the degradation of hydrocarbons by naturally occurring microbes. Pump-and-treat remediation was considered useful from risk management and hydraulic capture perspectives but was not considered to be particularly effective at hydrocarbon mass removal at the site compared to other remedial approaches, including source removal, manual hydrocarbon recovery and natural attenuation. In the future, lower cost alternatives, including manual hydrocarbon recovery and monitoring natural attenuation are proposed.

Brent Lennox

Brent Lennox is a senior hydrogeologist with Waterline Resources Inc. and has ten years of experience in contaminant hydrogeology, physical hydrogeology, and environmental geoscience. He is particularly focused on contaminant hydrogeology, environmental site assessments, and remediation and has experience with a wide variety of contaminant sources and environmental settings.

