Abstract: The National Energy Technology Laboratory and the U.S. Geological Survey are collaborating with BeneTerra LLC to comprehensively monitor a sub-surface drip irrigation (SDI) system at a site in the Powder River Basin (PRB) of Wyoming. Irrigation water for the SDI system is coalbed natural gas (CBNG) co-produced water. The study is being conducted at the Headgate Draw area, located approximately 17 km south of Arvada, Wyoming at the confluence of Crazy Woman Creek and the Powder River. The study site encompasses six alfalfa fields and covers an approximate area of 1.2 km$^2$.

Subsurface drip irrigation (SDI) is an emerging technology being applied in the PRB basin for the beneficial use of CBNG co-produced water. The pre-treated CBNG waters are applied to the root zones of agricultural land to aid in irrigation. Water drains from the emitters at a rate of 2.8 to 5.6 L/day. This style of irrigation is capable of applying two to three times more water on a particular site than traditional surface irrigation (Engle and others 2009a and b). The method is designed to minimize environmental impacts by parking potentially detrimental salts in the vadose zone. This research project investigates the transport and fate of the water and salts from the injected CBNG produced waters at the SDI site, adjacent to the Powder River.

Ground, borehole, and helicopter electromagnetic (EM) conductivity surveys were conducted at the site prior to the installation of the SDI system (Sams and others 2008a and b; Smith and others, 2009). After the installation of the subsurface drip irrigation system, ground EM surveys have been performed quarterly (weather permitting). The results of this investigation indicate that ground based geophysical instruments, such as the Geophex GEM 2, provide a method for characterizing near surface EM properties. These types of EM surveys provide useful data to optimize the design of SDI systems and monitor EM properties over time. Ground GEM 2 surveys are promising for tracking salt movements and possible alterations in soil properties. This paper summarizes geophysical survey results from the 5-year study of the SDI system.

No full paper available.