

Methodologies Developed to Estimate and Remediate the Impact of Longwall Mining on Springs in the Bull Mountains of East-central Montana

Phillip E. Brown and Dorothy E. Baldwin

ABSTRACT

Meridian Minerals (Meridian) recently received a permit to develop a longwall coal mine in the Bull Mountains of east-central Montana. To obtain this permit the application had to satisfy the Montana Department of State Lands (MDSL) requirements that:

- The hydrogeology of the site, including the origin of the 130 springs within the proposed permit area, was understood; and
- A remediation program that assured the restoration of the hydrologic functions of the springs, should subsidence due to mining impact the springs, was developed.

To meet these requirements, Meridian completed an initial hydrogeologic investigation and implemented an extensive baseline hydrogeologic monitoring network that included 61 wells, 130 springs, and over 10 surface water stations. In addition, hundreds of water samples were collected and analyzed, flow and water level data were collected, and numerous aquifer tests were performed. However, these studies were not sufficient to determine what controlled the occurrence of the springs and without this knowledge;

- Potential impacts to the springs from predicted mine subsidence could not be evaluated; and
- Methods for mitigating potential impacts could not be developed.

Using innovative and traditional hydrogeologic data acquisition and interpretation techniques, a field program was developed and implemented to specifically collect data that identified the discharge mechanisms for the springs. The results indicated that the springs were controlled by ground water flow through a shallow fractured bedrock system that was limited to the valleys, not by flow through laterally continuous aquifers as proposed by others.

This conceptual ground water model coupled with the subsidence model developed by mining engineers was used to design;

- A system for ranking the springs in terms of their probability of being impacted by mine subsidence; and
- A remediation program which mimicked the natural flow regime and assured that the hydrologic functions of the springs would be restored.