5.0 CONCLUSIONS

1. The conceptual B- and E-seam mining model presented in the Exhibit 60 series of the mining permit has been verified by annual field observations in the various West Elk Mine mining areas. With the use of longwall mining methods where the uniform downwarping of the overburden rocks and unconsolidated material act as laterally constrained plates, cracks in zones under tensile stress narrow with depth, and close at the neutral surface. Below the neutral surface, the materials are therefore in compression. This has an important bearing on the hydrologic consequences of longwall mining. Any groundwater or surface water in contact with a given subsidence crack is prevented from traveling downward beyond the neutral surface of the deformed plate. Annual field observations from 1996 to spring 2019, inclusive, verify this conceptual model in bedrock and surficial material (colluvium, alluvium, mudflow, and debris flow deposits) where the overburden is laterally constrained.

2. Typically, uniform downwarping occurs in association with longwall mining when there is lateral constraint. Where there are steep slopes and cliffs, there is little lateral support in at least one direction, which causes the associated rocks and unconsolidated materials to deform like unconstrained beams, plates, or cantilevers as the longwall mining faces move beneath them. This lack of lateral constraint allows subsidence cracks to commonly extend completely through sandstones and other brittle units, and groundwater or surface water present near or within these cracks will likely flow through and exit into existing surface drainages. The relatively few cliffs and over-steepened slopes in the Southern Panels Mining Area tend to provide the lateral constraint needed to produce a more uniform down-warping with fewer significant subsidence cracks observable at the surface.

3. To date, there have been no observed or reported water losses associated with the longwall mining activities.

4. Continuous annual observations find substantial weathering of previously observed subsidence cracks with edges rounding, widths reducing, and depths filling with eroded