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Mayo and Associates, LC
Consultants in Hydrogeology

21 February 2000

Mr. Charles Reynolds
C.W. Mining Company
P.O. Box 1245
Huntington, Utah 84528

Copy Sharon & Jim
Cleaning
ACT/015/025

Re: Response to concerns of Castle Valley Special Service District

Charles,

We have reviewed the letter submitted by Mr. Darrel Leamaster to the Division of Oil, Gas and Mining regarding the Wild Horse Ridge Amendment. We are writing this letter to specifically address Mr. Leamaster's concern regarding the possibility that mining in the Wild Horse Ridge area will affect Big Bear Spring.

Mr. Leamaster states that "Co-Op does not know the source of recharge for the spring and therefore the impacts of mining can not be predicted". Although we agree that the recharge and flow path locations of Big Bear Spring have not been specifically determined, we feel that it is certainly possible to exclude certain areas and geologic structures as potential recharge sources or flow path locations.

Specifically, Mr. Leamaster states that the Bear Canyon Fault may be the source of water discharging from Big Bear Spring and that fractures associated with the fault may convey water from the fault to the spring. He is concerned that mining in the Wild Horse Ridge area may encounter water in or near the Bear Canyon Fault and thereby diminish the discharge rate of Big Bear Spring.

We believe with a good degree of certainty that mining in the Wild Horse Ridge area will not have any impact on Big Bear Spring. This position has been stated in our report, which is Appendix 7-J of C.W. Mining's Wild Horse Ridge permit amendment. Specifically, our position is based on the six points listed below.

1. The vertical offset of the Bear Canyon Fault is approximately 230 feet (MRP, Chap 6). It has been our experience that faults with large displacements in the Blackhawk Formation, Star Point Sandstone, and Mancos Shale are almost always filled with relatively impermeable fault gouge (smeared and pulverized rock resulting from motion along the fault) because of abundant shale and mudstone. This suggests that the plane of the Bear Canyon Fault is certainly filled with fault gouge. Where the Bear Canyon Fault is exposed near the headwaters of Bear

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Canyon, extensive fault gouge is visible. Fault gouge is generally not capable of transmitting water as demonstrated by the lack of water in the gouge of the Blind Canyon Fault where encountered by the Bear Canyon Mine (MRP, Appendix 7-J, p. 78).

If, as we suppose, the Bear Canyon Fault is filled with gouge, then the fault is a barrier to flow both vertically down the fault, laterally along the fault, or perpendicularly across the fault. While, the fault plane itself may not support groundwater or groundwater flow, fault-associated fractures on either side of the fault may support groundwater flow. The fault plane, because it is filled with impermeable materials, hydraulically isolates groundwater on one side of the fault with groundwater on the other side of the fault.

Consequently, any water-bearing fractures east of the Bear Canyon Fault are not in hydraulic communication with fractures west of the fault that may be supporting groundwater flow to Big Bear Spring. And so, mining in the Wild Horse Ridge should not impact Big Bear Spring.

2. We have postulated that groundwater recharge to the Panther Sandstone occurs where the Panther Sandstone is exposed at or near the surface and the little water recharges the Panther Sandstone from overlying horizons (MRP, Appendix 7-J, p. 103). Along the Bear Canyon Fault, adjacent to the Wild Horse Ridge area, the Panther Sandstone is juxtaposed against the Blackhawk Formation, because of 230 feet of vertical movement along the Bear Canyon Fault. Consequently there can be no direct hydraulic communication between the Panther Sandstone west of the Bear Canyon Fault where Big Bear Spring is located and the Panther Sandstone east of the fault in Wild Horse Ridge.

3. The rocks in the Wild Horse Ridge area dip to the southeast (MRP, Chap 6). Thus, groundwater in bedrock formations in the Wild Horse Ridge area would naturally flow to the southeast, away from the Bear Canyon Fault and away from Big Bear Spring.

4. Groundwater that may be associated with the Bear Canyon Fault was encountered in the Hiawatha Complex approximately 5 miles north of the Bear Canyon Mine. This water, which now discharges from the Mohrland Portal, has a radiocarbon age in excess of 9,000 years, which is considerably older than water in either Big Bear Spring or the Bear Canyon Mine (MRP, Appendix 7-J, pp. 60, 85-88). Thus, water inflows to the Bear Canyon Mine or water discharging from Big Bear Spring is not the same water that is associated with the Bear Canyon Fault in the Hiawatha Complex. This indicates that the Bear Canyon Fault does not convey water from the Hiawatha area to the Bear Canyon area.

5. Two springs, 16-7-24-3 and 16-7-24-4, discharge from the Blackhawk Formation immediately east of the Bear Canyon Fault in Bear Canyon. A third spring, WHR-6, discharges from the Spring Canyon Sandstone near the location of the proposed portals for the Wild Horse Ridge expansion. All three of these waters have elevated TDS contents relative to Big Bear Spring or water encountered in the Bear Canyon Mine. These waters also have unusual chemical compositions with magnesium and sulfate being the dominant ions compared to Big Bear Spring water in which calcium and bicarbonate dominate (MRP, Appendix 7-J, pp. 76-79, 129). These chemical data suggest that there is no hydraulic communication between the area east and the area west of the Bear Canyon Fault.

If we can be of further assistance, please do not hesitate to contact us.

Regards,

Kelly Payne

Kelly Payne
Hydrogeologist

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