

Rebuttal to portions of "Expert Report and Narrative Relative to Water Right Transfer #79384 for Irrigation" prepared for Cedar Ridge Dairy by Brockway Engineering, PLLC

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Eastern Region

by Bill Bonnicksen, Ph.D.

Summary: This report primarily shows why groundwater does not flow from the Mule Creek-Jackpot area northward into the Salmon Tract.

I draw the reader's attention to the discussion of geology and hydrogeology on pages 7-10 of Brockway Engineering's expert report. This report cites three published reports, Fowler (1960), Moore and Eakin (1968), and Crosthwaite (1969) for their geologic appraisal of the area where the Leno Well in sec. 20, T16S, R16E, near Mule Creek, from which a water right is proposed to be transferred, and for the dairy area in sec. 7, T11S, R16E, to which the water right would be transferred.

Does Groundwater Flow Northward from Jackpot?

Brockway Engineering concludes from these reports that groundwater will flow northward from the general area of Jackpot in northern Nevada to the area where the dairy is situated. Several reasons why this is unlikely are:

1. The reports by Fowler (1960) and Crosthwaite (1969) are quite general in their geologic description of the Salmon Tract, which is irrigated by water diverted from Salmon Falls Creek. These reports do not discuss the specific geologic relationships either in the dairy area, or in the Jackpot-Mule Creek area near the Idaho-Nevada border. In fact, these old reports do not consider aspects of the groundwater or of the geology south of T14S, where the south edge of the Salmon Tract and the north end of Salmon Falls Creek Reservoir are located, more than ten miles north of the Idaho-Nevada border. Thus, nothing in these reports documents the groundwater flow direction between the Jackpot-Mule Creek area and the Salmon Tract.
2. The report by Moore and Eakin (1968) is a very general discussion of hydrological conditions in a 5000 square miles region in northeastern Nevada containing several streams that eventually flow north to the Snake River. It makes only minor mention of geologic conditions near Jackpot, and cites no geologic evidence why significant quantities of groundwater in the vicinity of Jackpot should flow north to the Salmon Tract in Idaho. They do note, however, that (start of last paragraph, p. 28):

The shallow ground water along Salmon Falls Creek near the mouth of Shoshone Creek implies that underflow from that area is impeded significantly, most probably by a north-trending fault along the east side of the hills and west of U.S. Highway 93.

In contrast to what Moore and Eakin state, the Brockway Engineering report states that (bottom p.10 & top p.11):

The report also indicates that the shallow ground water along the Salmon Falls Creek near to the mouth of Shoshone Creek is affected by a north trending fault line that is located on the east side of the foot hills but west of Highway 93.

Brockway Engineering goes on to state (end of paragraph, top of p.10) that:

The ground water will continue to flow down gradient into Idaho towards the Snake River.

Thus, Brockway Engineering not only glosses over what their cited reference actually stated, but go on to draw an unsubstantiated conclusion regarding the direction groundwater would flow.

3. Shoshone Creek joins Salmon Falls Creek about 3.7 miles south of the Idaho-Nevada border. My geologic investigations in this area indicate that the fault at that location mentioned by Moore and Eakin (1960) is a normal fault with its east side dropped down by more than 500 feet. This displacement may be as much as several thousand feet because the down-dropped area east of the fault is hidden beneath younger sediments. This fault forms part of the boundary to the structural basin across which Salmon Falls Creek flows. I agree with Moore and Eakin's assessment that this fault likely impedes the flow of groundwater from the basin because the rocks on the upraised western side of the fault are densely welded rhyolitic tuffs with interlayers of densely compacted, fine-grained rhyolitic ash that would be fairly impervious to groundwater flow.

4. Other faults bound this structural basin, including an important one located just north of the Leno well near Mule Creek. This fault trends northwest and has a south-side-down displacement of about 1500 feet, judging by the elevation of the welded tuff layers in the hills just north of the fault and the depth at which similar welded tuffs were encountered in a 1080-foot-deep well drilled in the NW corner of sec. 32, T16S R16E. The log of this well reveals that the basin is mainly filled with fine-grained sedimentary materials that are younger than the welded tuff layers. Again, the effect of this fault would be to keep water contained within the basin, rather than to have it trickle out and flow northward through the dense rhyolitic welded tuff layers on the north side of the fault.

5. The region through which Salmon Falls Creek flows, between the Jackpot area and the north end of Salmon Falls Creek Reservoir, which is in T15S and T16S and which was not discussed by either Fowler (1960) or Crosthwaite (1969), and that has been presumed by Brockway Engineering to be an area where groundwater would flow northward, needs further consideration. This area occupies the central part of the Rogerson graben, a structural trough a few miles wide that was formed between about 10 and 8 million years ago by down dropping along large-displacement north-trending faults on both sides of the valley. Within the valley are dense rhyolitic welded tuff layers that are younger than the faulting which formed the graben. The

most notable of these is the Greys Landing Ignimbrite (e.g. welded tuff), which has been mapped and described in detail by Andrews and others (2008). Examination of the map and stratigraphic sections presented in that paper shows there are no zones suitable to transmit significant amounts of groundwater in the rocks that floor the graben; instead they consist of dense rhyolite and interlayers of densely-compacted volcanic ash and ancient, clay-rich soils.

6. At the sides of the Rogerson graben, older rhyolitic welded tuff layers are exposed; these also would not readily transmit very much water. Brief descriptions of these older welded tuff layers are available in the appendices of a paper I developed several years ago as part of a study of the rhyolitic rocks around the central Snake River Plain (Bonnichsen and others, 2008). These older welded tuff layers are present below the younger Greys Landing welded tuff, beneath the floor of the Rogerson graben. The point of this is that there does not appear to be a set of rocks within the graben, or on its sides, that would permit much ground water to flow northward.

7. In the expert report (submitted 11 Feb 2015) that I wrote for this water-transfer proceeding, I noted that a drainage divide exists between north- and south-flowing streams that irregularly extends from west to east across the Rogerson graben and eastward to separate the Shoshone Creek drainage basin, including its south-flowing tributary, Mule Creek, from streams and other watercourses that flow northward into the Salmon Tract area. Geologically, this drainage divide separates generally southward-sloping topography from northward-sloping topography. More importantly, from a groundwater flow direction perspective, it also separates rock layers that dip northward from parts of the same layers located south of the divide that dip shallowly southward or are approximately horizontal. This supports the concept that groundwater south of the divide, like in the alluvium-filled Mule Creek channel and other watercourses south of the divide, would migrate southward toward the deep, sediment-filled basin extending southward from the Jackpot area, rather than northward toward the Salmon Tract.

The Nature of the Aquifer near the Dairy

On page 8 (end of first paragraph), the Brockway Engineering report, citing the paper by Fowler (1960), states:

Wells in the area have drilled through Snake River Basalt and into sedimentary strata consisting of silt, clay, sand and some gravel. It is this sedimentary strata that provides water to domestic, stock and smaller irrigation wells.

I disagree with this assessment of how groundwater is mainly transported, especially near the dairy. Drill logs in that area, and within a few miles to the south, show little sedimentary material beneath the basalt; rather it is mainly rhyolite as I indicated in my expert report of 11 Feb 2015. In the area near the dairy the water principally passes through basalt. In fact, many wells in that area were terminated in

basalt and still produce amounts of water adequate for the purpose for which they were drilled. I would suggest that the concept of sediments beneath the basalt that are capable of providing abundant groundwater supplies is more applicable to areas several miles north and northwest of the dairy, where a thick accumulation of lake sediments is present beneath the basalt, and above the underlying rhyolite. Such relations can be seen in Salmon Falls Creek canyon in the Deep Creek area, west of Buhl, and in the Melon Valley area adjacent to the Snake River, north of Buhl.

Conclusions

A combination of geological and topographic factors strongly suggests that groundwater does not flow northward from the enclosed basin in the Jackpot area to the Salmon Tract. Instead, groundwater in the Mule Creek drainage flows downslope southward into Shoshone Creek and Salmon Falls Creek where it is stored in the thick fill of lacustrine and fluvial sediments in an enclosed basin. This water is deterred from flowing northward by faults that bound the basin and by the lack of permeable rock layers in the Rogerson graben north of the basin that would permit significant amounts of water to pass, as well as the southward tilt of the surface and the rock layers there.

The principal aquifer in the area around and south of the Cedar Ridge Dairy is basalt, and not sediments beneath the basalt. Dense rhyolite and intercalated layers of compacted volcanic ash, clay, and other fine-grained sediments are the materials that occur beneath the basalt in that area, and generally have a low capacity for sustained groundwater flow except at a rate much lower than that found in the overlying basalt.

Note: The comments and conclusions in this rebuttal would also apply to proposed transfers #79357 and #79380.

References Cited

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