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October 31,2017

Mr. Daniel Ferguson
132 10 Judge Orr Road
Peyton, CO 80831-8401

RE: Water availability for Property
in Falcon, Colorado

Dear Mr. Ferguson:

I have misplaced your e-mail address, to my chagrin, so I am using the old-fashioned, snail mail method of communicating.

You asked that I answer some questions about water availability underlying your 327.1 acre property in Section 32, T. 12 S., R. 64 W., 6th P.M.

I am attaching a printout I made by using the State Engineer's aquifer determination tool for your property. It estimates that the amount of water underlying the Property is as follows:

- Dawson aquifer, 7,180 acre feet total, which may be pumped at an average rate not to exceed 71.8 acre feet annually;

- Denver aquifer, 11,407 acre feet total, which may be pumped at an average rate not to exceed 114 acre feet annually;

- Arapahoe aquifer, 10,268 acre feet total, which may be pumped at an average rate not to exceed 103 acre feet annually;

- Laramie-Fox Hills aquifer, 9,346 acre feet total, which may be pumped at a rate not to exceed 93.46 acre feet annually.

I don't know how much you know about Denver Basin water rights (for example, whether you know that the Denver Basin aquifers consist of the four aquifers enumerated above). I want to give you some information which you ought to know as you seek to have your property included in the nearby water and sanitation district – Woodmen Hills, I think you said.

First, the state legislature passed a series of laws in 1985 relating to these aquifers. As you are probably aware, the aquifers will not be replenished, at least not in a planning period that

humans commonly use; once the water is used up, it isn't coming back. The legislature provided that the water in these aquifers must be made to last 100 years. Hence, when one speaks of, for example, 25 acre feet of water in the Denver aquifer, that typically means the right to pump 25 acre feet annually for 100 years.

In 1986, El Paso County determined that it would not approve subdivisoins which use any of the Denver Basins aquifers as their source of water to be predicated on that 100 year period. Instead, in El Paso County, one planning to subdivide and use Denver Basin aquifer as a source of water supply must provide for a 300 year water supply. Thus, if one had 100 acre feet (per year) of only one aquifer, that could supply a subdivision at a rate of 33.3 acre feet annually, not 100 acre feet. That way, the 10,000 acre feet (100 acre feet per year X 100 years) will last for 300 years.

That is the rule for subdivisions within the County, but not within municipalities or special districts, like water and sanitation districts. They may use formulate their own rules, so long as the rules are no less restrictive than the State's 100 year rule. Thus, what the water and sanitation district provides regarding the dedication of water to the water and sanitation district as a condition of inclusion in the district will have a very direct bearing on the densities that the property can develop, and hence on profitability.

In addition, you should be aware of the difference between nontributary ground water and ground water which is not nontributary, which is called "not nontributary' ground water. As indicated in the final column of the attachment, the Lower Dawson and Denver aquifer water underlying your property is <u>not</u> nontributary, whereas the water in the Arapahoe and Laramie-Fox Hills aquifers is nontributary

Nontributary ground water, for all practical purposes, is not hydraulically connected to any surface streams. Thus, if one were to drill a well into a nontributary aquifer, only 100 feet from a surface stream, pumping from that aquifer would not impact the flow in the surface stream, not even after years and years of pumping. On the other hand, pumping water from an aquifer which is not nontributary will, over time, impact the availability of water in the surface streams and the soils near those streams. That is because where those aquifers outcrop, the water is slowly draining from them and seeping into the soil along those water drainages. The water moves through not nontributary aquifers quite slowly, but it does move.

Nontributary ground water may be approved for practically any beneficial use, the only proviso being that only 98 percent off the water pumped may be used up, or consumed. As a practical matter, about the only way to fully consume water would be to export it out of the Upper Black Squirrel Creek Designated Ground Water Basin. Even drip irrigation could be expected to return two percent of the water used to the stream.

Not-nontributary water is a different matter. As I stated above, water which is not

nontributary is connected to the streams, or in the case of the Upper Black Squirrel Creek drainage, more to the alluvial sands and gravels along drainages. The water in not nontributary aquifers will, if not pumped, slowly seep into those areas in locations where the overlying land has eroded away. Conversely, pumping such water will mean that some of the water which would naturally have seeped into the water channels will no longer do so, thus diminishing the source of water for owners of shallower wells, such as (but not limited to) the sod farmers closer to Ellicott.

If one wishes to use not nontributary water (other than in small capacity wells, which are typically approved for only small quantities of water use), one must first obtain approval of a replacement plan. In a replacement plan, the applicant must identify the amount of water which will be used up, or consumed, and make provisions to replace that water at the time and in the amount and location at which the pumping affects the surface streams – or in your case, the water in the alluvial channels of Upper Black Squirrel Creek and its tributaries.

As an example, it is generally assumed that use of water for indoor drinking and sanitary purposes, and disposal of the rest by nonevaporative septic systems, will result in consumption of 10 percent of the amount so used. So if one was going to provide 0.2 acre foot annually for each of 100 homes, for indoor uses only, the amount consumed would be 0.2 acre foot per home X 100 homes X 10 percent, or two acre feet annually. That amount of water, 2.0 acre feet annually, must be replaced to the alluvial channels and overburden soils, rather than to the aquifer from which it was pumped.

Making this more complicated is the fact that the passage of water through the sandstone aquifers of the Denver Basin is slow. Thus, one acre foot of not nontributary water pumped today will not immediately affect the amount of water in the alluvium. The State Engineer has a computer model for each of the not nontributary aquifers which predicts how what the depletions caused by pumping from that aquifer will be at different times. For example, if one pumps 100 acre feet annually from a not nontributary aquifer, the effect of such pumping on the aquifer will be immediate; the water is gone from the aquifer. However, the effect on the streams and alluvial systems is much slower. To make up an example, assume pumping of 100 acre feet annually for 100 years. In the first year, the modeled depletions to the streams and alluvial systems will be zero. If you cease pumping that amount of water in the 100th year, the effect on the stream and alluvial systems of pumping during that year and all previous years might be 20 acre feet. Thus, a replacement plan needs to figure out a way to replace an amount of water which starts at zero acre feet, but rises over time to 20 acre feet in the 100th year.

There are typically two ways that this is done. The first is to take credit for the return flows from the water uses. For example, if the 100 acre feet are pumped for 200 homes, once can assume that about 40 acre feet will be used in the homes and the amounts which goes down the drain will return to the alluvium in the case of homes with septic systems, or will be treated at a central wastewater treatment plant and then be discharged to the soil. This can be used to offset

the depletions, and if the return flows from 40 acre feet for indoor uses were treated in septic systems, the amount which returns to the soil would be about 36 acre feet annually. In the example, that is more than the 20 acre feet of hypothetical depletions.

There are other times when the septic system or wastewater treatment plant discharges will be less than the depletions, at least during the later years of pumping as the depletions become greater as a percentage of the water pumped. In that case, the difference between the annual depletions and the annual septic system return flows can be made up by pumping water from a nontributary aquifer.

This may be more than you either needed or wanted to know. However, I thought that you should have this information in mind as you go through the process of analyzing what the water and sanitation district tells you about what sort of "credit" you will receive for the water underlying your property as you contemplate having it included in the district.

I hope that all of this information will prove useful as you negotiate inclusion in the Woodmen Hills Metro District. Please do not hesitate to let me know if you have questions.

Sincerely yours,

/s/

Henry D. Worley

Attachment