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Ms. Laura Hartt
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RE: Public Comments on Proposed Groundwater Allocation Rules

Dear Ms. Hartt:

On behalf of the Oregon Ground Water Association, I am providing the following comments on the proposed Groundwater Allocation Rules.

First, I would like to summarize my qualifications: I have a Master's degree in Hydrology and Water Resources from the University of Arizona. I am a Registered Geologist and Certified Water Rights Examiner in Oregon, and a Licensed Geologist with Hydrogeology specialty in Washington. I have been involved in the protection and management of groundwater resources in some manner for over 35 years. In the last 21 years, I have dedicated most of my professional career to applying my background in hydrogeology and water rights for the purpose of assisting farmers, nursery operators, vineyard owners, and commercial and industrial clients with their water right needs. Our company works throughout Oregon, but mainly in the Willamette Valley. I am currently the Chair of the Oregon Groundwater Association's Government Affairs Committee. I also served on the Rules Advisory Committee (RAC) for these proposed rules. I am not listing my qualifications to sound impressive, but to let the reader know that my academic and technical qualifications are at least on par with those of the OWRD Groundwater Section staff, and that I have considerable knowledge on the subjects relevant to the proposed rules from many years of work in the private sector as a hydrogeologist and water right consultant.

The following discussion and comments come directly from a comment letter I submitted previously on behalf of the Oregon Ground Water Association following the seventh RAC meeting. Since that meeting, none of the changes made to the proposed rules have altered my perspective. Therefore, what follows is a fairly comprehensive discussion of the concerns we have about the proposed rules, and our suggestions for moving forward.

INTRODUCTION

The population of the planet continues to grow, especially in underdeveloped countries. We will continue to have the need to produce more food to feed the world, so it would seem foolish to intentionally forgo opportunities to finish developing the limited amount of prime farmland that is not covered with water rights. But that is exactly what the proposed groundwater allocation rules will do in their current form.

The current proposed rules rely on three basic tests to allow issuance of a new groundwater right permit. These three tests are: 1. Reasonably stable water levels, 2. No potential for substantial interference with surface water, and 3. Groundwater is available within the capacity of the resource. As I have said in previous comments in RAC meetings and in testimony before the Commission, these three tests form the legs of a three-legged stool. If any one of these tests (i.e., legs of the stool) fails, the stool will collapse and a permit cannot be issued. The third test, or leg of the stool, which is whether groundwater is available within the capacity of the resource, is pretty straightforward, since it only requires that the requested rate of pumping does not exceed what could be expected from a similarly constructed well in the area. This standard should not be too much of a challenge for an applicant to meet or for the Department to verify. Which really leaves us with two main challenging issues to address with these rules: reasonably stable water levels; and the potential for substantial interference with surface water.

REASONABLY STABLE WATER LEVELS

Throughout the rulemaking process, there has been a strong emphasis on developing rules that were firmly based in sound science. The Department has recently put a great deal of effort into developing a system for determining if water levels are reasonably stable. Overall, the approach developed by the OWRD for determining if groundwater levels are reasonably stable appears to live up to the objective of developing rules well founded in science, and I applaud the Department's efforts on this issue.

POTENTIAL FOR SUBSTANTIAL INTERFERENCE

I believe there still remains much work to be done to develop a solid, science-based foundation for determining if there is substantial interference with surface water. First, there must be a determination if there is a hydraulic connection between the proposed well(s) and nearby, effected surface waters. If there is a hydraulic connection, and the impacted stream is shown to be over-appropriated according to the WARS database, there will be a finding of the Potential for Substantial Interference (PSI). A finding of PSI will toll the death knell for that application. Inherent in making the PSI determination is the assumption that *any* degree of hydraulic connection with a stream that is already over-appropriated (according to WARS) will result in "substantial interference" with that stream. This assumption seems to be based largely on the principals discussed in the US Geological Survey report by Barlow and Leake (USGS, 2012). Barlow and Leake describe how, under very specific hydrogeologic conditions, a pumping well will eventually cause depletion of a nearby stream in an amount equal to the full pumping rate from the well (USGS, 2012). To model these impacts, the Department may use certain simple analytical models for estimating streamflow depletion, such as Jenkins (1968, 1970) and Hunt (1999, 2003). The way these simple models operate, it is impossible to get a result of zero stream depletion, especially if the models are run "...over the full term of the proposed or authorized groundwater use..." (proposed OAR 690-009-0040(4)), that is, in perpetuity. Concerns about these various factors are discussed in further detail, below.

Hydraulic Connection

We have been told that the Department will not change how they determine hydraulic connection for these new rules. Consider, however, that the distance limits imposed by the existing rules (i.e., ¼ mile and 1 mile) will no longer be in effect. This means the Department can look for hydraulic connection with streams at any distance from the proposed wells. There needs to be practical limits on how far to look for hydraulic connection. For example, does is make sense to go beyond the boundaries of the water availability basin in which the proposed well is located? Also, when in the Willamette Valley, does it make sense to even consider hydraulic connection with nearby, shallow streams when there are several tens of feet of Willamette Silt overlying the shallowest productive water bearing zone?

As stated in Justin Iverson's Master of Science Thesis (Iverson, 2002), "...the low hydraulic conductivity of the [Willamette Silt] provides a hydraulic buffer to depletion of streams bottoming in the WS [Willamette Silt] under pumping stress generated in the underlying WA [Willamette Aquifer]. Volumetric balance analysis shows that less than 1% of the water removed from the aquifer at a pumping well near the river was recharged to the Willamette Silt from the Pudding River." These results were from an analysis of a pumping well located only about 100 feet from the Pudding River and screened in the Willamette Aquifer only a few feet below the bottom of the Willamette Silt. Limitations under the existing rules constrain locating new wells to distances more than ¼ mile (1,320 feet) from any nearby stream. Furthermore, many irrigation wells are completed at greater depths to develop more productive water bearing zones which are further separated from the overlying Willamette Silt by intervening semi-confining layers of silt and clay. Therefore, the findings in Iverson's thesis likely represent a worst-case scenario. This suggests that making an assumption of hydraulic connection based on the theoretical possibility that it may occur at some infinitesimal level is not a method based on sound science.

Barlow and Leake Report

The Department seems to be relying completely on the theories presented in Barlow and Leake (USGS, 2012) to assume that pumping a well will result in stream depletion equal to the full pumping rate for any nearby, hydraulically connected stream within some reasonable timeframe. These theories are only strictly applicable to a system where a single, unconfined aquifer is discharging to a single stream. Barlow and Leake (USGS, 2012) states:

> *In many areas of the United States, groundwater systems are composed of a vertical sequence of aquifers in which an upper, unconfined aquifer is underlain by a series of one or more confining beds and confined aquifers, such as is illustrated in figure 1 [below]. In many other areas, however, the ground-water system consists of a single, often unconfined, aquifer underlain by geologic formations, such as crystalline rock, whose permeabilities are so low that the formation can be assumed to be impermeable to groundwater flow. Aquifers of this type are used throughout the report to illustrate many of the factors that affect streamflow depletion by wells.*

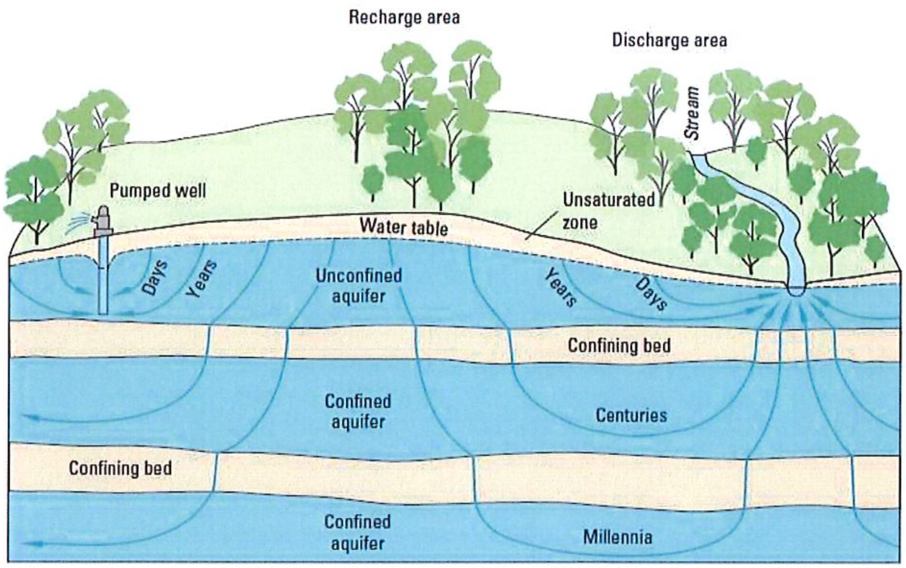

Figure 1. Groundwater flow paths in a multi-aquifer groundwater system. Groundwater flows from recharge areas at the water table to discharge locations at the stream and well. The residence time of groundwater can range from days to millennia (modified from Winter and others, 1998).

If it is not clear from the above quote, the principles discussed in the Barlow and Leake report are directly applicable only to systems consisting of a single, unconfined, aquifer underlain by effectively impermeable geologic formations. Throughout Oregon, most aquifer systems which are hydraulically connected to surface water do *not* fit that description, but are instead more likely to be characterized by a groundwater system similar to what is shown in Figure 1, above, which is to say, a much more complex system consisting of multiple layers of confining or semi-confining beds and confined or semi-confined aquifers. In the Willamette Valley, the groundwater system is similar to what is shown in Figure 1, but with a thick layer of Willamette Silt over the top of everything. In most places, the Willamette Silt is so thick that the nearby streams are not even close to incising all the way through it. Consider, therefore, the common situation where you have an irrigation well constructed to develop water from a deeper water-bearing zone, illustrated by the deepest confined aquifer shown in Figure 1, above. Even *without* the presence of the Willamette Silt, the time for a pumping impact to reach the nearby stream from this deep well could be on the order of millennia. If you factor in the presence of several 10s of feet of Willamette Silt separating the bottom of the stream channel from the uppermost water-bearing zone, the possible pumping impacts from a deep well will be considerably reduced even further. Furthermore, none of the assumptions used in Barlow and Leake (USGS, 2012), or in the Jenkins (1968, 1970) and Hunt (1999, 2003) models, account for the upward flow of groundwater through an underlying aquitard that is induced from pumping in a shallower aquifer, as described by Butler, et al. (2007). According to Butler, et al. (2007), upward flow (leakage) through an underlying aquitard becomes an increasingly important component of the recharge to pumping wells with increasing distance from the stream.

It should be clear from these discussions that there are far too many complexities in these groundwater systems to be able to reliably predict the impact on individual streams following the assumptions and using the simple models typically employed by the OWRD. Thus, the broad application of these theories and models to the very complex aquifer systems found throughout most of the state is just not consistent with the objective of developing sound science-based rules.

The time frame for estimating potential pumping impacts on streams must also be considered. The currently proposed rules allow for estimating pumping impacts for the expected life of the water right. For a permanent water right, that means into infinity. As discussed above, under many circumstances, the theoretical pumping impacts to streams may not be realized for thousands of years. It is reasonable to expect that the way we cultivate and irrigate crops will continue to evolve, and in just 50 to 100 years we will likely be farming much more efficiently and using much less water than today. So, does it make sense to run the analytical stream depletion models (such as the Jenkins or Hunt models) out more than several decades? To do so with the assumption that the use will remain the same in perpetuity is not in keeping with the intent to write rules based in sound science.

Water Availability Reporting System (WARS) Database

One primary area of concern is the reliance on the current WARS database to determine that a nearby stream is over-allocated, which will trigger a finding of PSI. This use of the WARS database relies on two assumptions: 1. that the WARS database is an accurate measure of the water available in the stream; and 2. that surface water availability is a relevant factor in determining if groundwater is available for additional development. Each of these assumptions is discussed further below.

Accuracy of WARS Database. The WARS database was developed in the early 1990s using streamflow data from 1958 through 1987, and estimates of irrigation consumptive use based on the crop water requirements of the types and acreages of crops grown in Oregon in 1990 (OWRD, 2002).

Probably the main uncertainty with reliability of the WARS database lies with the estimates of irrigation consumptive use. It is probably fair to assume that these estimates were reasonably accurate at the time they were made. However, in the 34 years since these estimates were made, economic and market factors have forced many farmers to adopt more efficient methods of irrigation. Also, since that time, few additional acres of irrigation from surface water sources have been approved. Therefore, it is possible, even likely, that the consumptive uses in 1990 were significantly greater than they are today. This would result in the WARS database over-estimating consumptive use and thereby underestimating actual water availability. In any event, the WARS database is outdated and may not be a reliable measure of surface water availability.

Another concern about the WARS database is how instream water rights are incorporated into the surface water availability calculations. The WARS database provides surface water availability at two exceedance levels, 50% and 80%. This means that at 50% exceedance levels, the amount of available water shown in the database is expected to be met or exceeded 50% of the time. Similarly, at 80% exceedance, the amount of available water shown in the database is expected to be met or exceeded 80% of the time. So, a 50% exceedance level is a lower bar than an 80% exceedance level. Instream water rights are established based on how much water is available at 50% exceedance (the lower bar). However, the instream water rights established at 50% exceedance are subtracted from the 80% exceedance flows (the higher bar) to derive water availability at 80% exceedance. This process is completely illogical and unscientific, and only results in further diminishing the 80% exceedance flows, which are the flows applied when evaluating a new groundwater permit.

Relevance of Surface Water Availability. If groundwater levels are determined to be reasonably stable, then the aquifer fits the definition of a sustainable groundwater source in accordance with Gleeson et al. (2020). This would suggest that groundwater is available for further development. However, if a new well is proposed to develop water from that stable aquifer, and that well is determined to be hydraulically connected to a stream that is over-appropriated according to the WARS database, then the proposed new use will be summarily denied. This seems to conflate surface water availability with groundwater availability, and raises a number of questions. First, we need to understand how the surface water sources came to be over-appropriated. Did the OWRD simply approve too many surface water rights before they had a better idea of how much water was available? Has the State issued too many instream water rights which in many cases has resulted in over-allocation of streams? Do we even need to consider the WARS data when groundwater levels are determined to be stable?

Fundamentally, if groundwater levels are stable, the aquifers will continue to discharge water to the streams as they always have. Therefore, when groundwater levels are stable, it seems that surface water availability is completely a function of the out of stream consumptive uses and instream demands. In other words, when the groundwater system is stable, surface water over-allocation must be the result of other factors that are separate and independent of the groundwater system. This suggests that the primary determining factor for allowing a new groundwater use *should be reasonably stable groundwater levels*.

RECOMMENDATIONS FOR CONSIDERATION

I have discussed a number of concerns related to making a determination of PSI in the proposed new rules. They include:

- Broadly theoretical assumptions of hydraulic connection;
- Too much reliance on broadly applied hydrogeologic theory from Barlow and Leake (USGS, 2012);
- An outdated WARS database; and
- Irrelevance of surface water over-allocation when groundwater levels are stable.

All of the above issues illustrate that the methodology in the proposed rules for determining PSI do not meet the same scientific standard that is currently being applied to the rules for determining if groundwater levels are reasonably stable. The proposed rules for determining PSI are really just a rubber-stamp process for denial of new applications. This might be an acceptable approach (if not overly cautious) if the Department was only concerned with protecting fish. However, the Department is obligated by law to balance allocation of the state's water resources for all uses.

If the Department is truly committed to developing *all* of the groundwater allocation rules to the same science-based standard, then more time needs to be dedicated to developing the rules for determining PSI. At a minimum, the determination of reasonably stable water levels should become the primary, real-data, science-based factor for determining groundwater availability. A finding that groundwater levels are reasonably stable should be sufficient to determine that groundwater is available for further development, unless there is clear evidence that hydraulically connected surface water sources are experiencing historically declining flows. This evidence could be from the record of surface water regulation or historical streamflow measurements.

I don't claim to have all of the answers. There may be other factors that could be considered. It might require formation of a blue-ribbon work group of hydrologists, hydrogeologists, and water rights experts to come up with a comprehensive set of recommendations. If so, it would necessarily mean a pause in finalizing the rules, but the delay would not need to be unduly long. There is a lot at stake and so it is important that we get these rules right while we still have the chance.

Respectfully,

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References

Butler, J. J., X. Zhan, and V.A. Zlotnik, 2007, Pumping-Induced Drawdown and Stream Depletion in a Leaky Aquifer System, Ground Water, v. 45, no. 2, p. 178-186

Gleeson and others, 2002, Annual Review of Earth and Planetary Science, Volume 48, 2020, pp 431-463 (Figure 2b). Available at: https://www.annualreviews.org/doi/10.1146/annurev-earth-071719-055251.

Hunt, B., 1999, Unsteady stream depletion from ground water pumping: Ground Water, v. 27, no. 1, p. 98-102

Hunt, B., 2003, Unsteady stream depletion when pumping from semiconfined aquifer: Journal of Hydrologic Engineering, January/February, 2003.

Jenkins, C.T., 1968, Techniques for computing rate and volume of stream depletion by wells: Ground Water v. 6, no. 2, p. 37-46.

Jenkins, C.T., 1970, Computation of rate and volume of stream depletion by wells: U.S. Geological Survey Techniques of Water-Resources Investigations of the United States Geological Survey, Chapter D1, Book 4, 17 p.

OWRD, 2002, Determining Surface Water Availability in Oregon, by Richard M. Cooper, PE, State of Oregon, Water Resources Department, Open File Report SW 02-002.

USGS, 2012, Streamflow Depletion by Wells – Understanding and Managing the Effects of Groundwater Pumping on Streamflow, by P. M. Barlow and S. A. Leake, USGS Circular 1376.