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August 13, 2019

Migar Corp
PO Box 4582
Salem, OR 97302

Re: Peer review results

Dear Mr. Smith:

Marion County has received the results of the peer review of the hydrogeology report prepared by Tim O'Gara, for the property located at 8468 Bronco Dr. SE. A copy of the review is enclosed.

As you will find, the results are positive. Consequently, the requirements of chapter 181 of the Marion County Rural Zoning Ordinance (the "Sensitive Groundwater Overlay" zone) for evidence of a sustainable long-term water supply for the proposed development are satisfied. Please include a copy of the enclosed letter with your land division application. We have a copy of the Hydrogeology Review report, so you don't need to include another.

An application for a land division requires information not related to water supply, and this determination has no bearing on those matters. Please make sure you include all required materials when submitting your request.

Sincerely,

Lisa Milliman
Associate Planner

Encl.



Wood Environment & Infrastructure Solutions, Inc.
7376 SW Durham Road
Portland, Oregon
USA 97224
T: 503-639-3400
www.woodplc.com

August 6, 2019
Project # 9-61M-11202M

Lisa Milliman
Associate Planner
Marion County Planning Division
5155 Silverton Road
Salem, OR 97305

Subject: Wood Peer Review of *"Hydrogeology Review of Property Located At 8468 Bronco Dr. SE, Salem, Oregon"* by Tim O'Gara, R.G.

Dear Ms. Milliman,

At the request of Marion County, Wood Environment & Infrastructure Solutions, Inc. (Wood) reviewed the referenced report dated July 17, 2019 (received July 22) and supplemental information received on July 19 (mail) and August 5 (voice mail). The report was submitted by Tim O'Gara, R.G. (O'Gara) to Marion County to meet the requirements of the County's sensitive groundwater overlay (SGO) ordinance.

Wood's review of the report was based on the SGO ordinance and on Marion County's October 2005 manual for completing hydrogeology reviews and studies in compliance with the SGO ordinance. Specifically, Wood verified that the report contained the information required by Section 181.100(A) of the SGO ordinance and that it sufficiently demonstrated all items required by Section 181.100(B) in order to conduct an independent peer review.

Report Summary

The proposed development would result in nine new wells. The report reviewed the geologic and hydrogeologic setting in the study area, previous investigations, long-term water level data, water rights, well deepening and replacement wells, and provided a water budget.

The target aquifer for the proposed development is the Columbia River basalt. The water balance estimated that 44 percent of the available groundwater recharge would be used after the proposed development is completed, below the County cut-off threshold of 90 percent.

The report found no evidence of presently declining water level trends over time or excessive and recent numbers of well deepening or replacements in the aquifer within the study area.

Peer Review Findings

The above-referenced report included the sufficient elements required by Marion County's Chapter 181 SGO ordinance in order for peer independent review to be conducted by Wood.

Considering all the information submitted in the original report, O'Gara's conclusions are supported by the report. If, however, additional information not available at the time this peer review was completed should become available later, the findings of this peer review may need to be updated. Procedures and

assumptions used in the report are consistent with generally accepted professional consulting practices and principles in effect at the time and location the work was completed.

Please contact the undersigned at (503) 639-3400 if you have any questions.

Sincerely,

**Wood Environment & Infrastructure
Solutions, Inc.**



Russ Bunker, RG
Associate Senior Geologist

**Hydrology Review of Property Located
At 8468 Bronco Dr. SE
Salem, Oregon
For:**

Cheryll Smith

By:

Tim O'Gara, R.G.

July 17, 2019

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1.0 Introduction

Cheryll Smith has proposed to partition one approximately 20-acre lot into 10 lots that are approximately 2 acres each. The area is within an SGO-6 sensitive ground water overlay zone. (figures 1 through 3). The proposed water use is 48.22 acre-feet per year as shown on the Water use Inventory, which assumes a 6% Infiltration Rate.

Parcels with less than 6-acres in this area require a Hydrogeology Review according to Section 181.070(A)(2)(b) of the Marion County Rural Zoning Ordinance (MCRZO). Additionally, the water use inventory calculated that percent of recharge would be used assuming a recharge rate of 6%. When a Water use Inventory indicates that more than 90% of recharge will be used with the proposed partition, Marion County required a Hydrogeology Review according to Section 181.090 (C)(1)(b) of the Marion County Rural County Zoning Ordinance.

Tim O'Gara, R.G. was authorized by Ms. Cheryll Smith on June 24, 2019 to complete a Hydrogeology Review at the above site and surrounding area (figure 1, Site Location map). The Hydrogeology Review follows the requirements outlined in the County's Sensitive Ground water overlay Zone ordinance (MRZCO Chapter 181) which became effective on January 1, 1998, and the guidance manual prepared by Marion County Planning division in 1998.

This investigation (1) provides a background of general geology and hydrogeology of the area from a previous nearby investigation, (2) reviews the hydrogeology within the study area using well logs from the Oregon Water Resources Department to determine which type of aquifer (e.g., basalt, marine, sediments, etc.) will be developed by the proposed land use, (3) researches well deepening or replacements, and (4) calculates an estimated ground water budget. Under the ordinance, additional development is allowable without a further Hydrogeologic Study only if existing information is adequate to determine that (1) less than 90% of the recharge within the study area are of concern would be used after the proposed lot split is completed, (2) the proposed lot split will not adversely affect the long term water supply of existing and potential new uses on existing parcels and (3) the additional proposed use will not deplete the ground water resource over the long or short term [MCRZO 181.100(C)].

2.0 Background and previous investigations in the area

The proposed partition is in Township 8 South, Range 3 West, in the NE/SE quarter/quarter of Section 23 and the SE/NE quarter/quarter of Section 24. The study area is within Sections 23 and 24. (Figure 1). The study area centers around parcel 082W23D00200 and extends at least a quarter mile from the outside edge of the proposed partition as shown on figures 2 and 3.

The topography of the study area consists of gentle rolling hills. Ground surface elevation is approximately 480 feet on the north and drops to 350 feet at the south-southeast. The property in question is quite flat with an elevation that ranges between 423 feet on the north and 410 feet elevation on the south. The average elevation is about 415 feet msl.

In general, the site is covered by varying thickness of silts and clays that overlie several flows of the Columbia River Basalt group. According to well logs in the area, the vast majority of the site is underlain by the basalt. On the fringes of the study area, some wells are pulling from sandstone, and one is reported to be getting its water from a shale/claystone formation. Several of the parcels in the area are densely wooded.

Tables 1 and 2 show the wells within the study area that could be located by an address on the log. It shows the address, screen depth, the formation that is producing the water, and the pumping rate at the time of installation.

Table 1
Identified Well Logs
T8S/ R 2W Sect 23

Well No.	Address	Total Depth (ft)	Screened area	Source formation	Flow at time of installation (GPM)
10734 10735 (deepen)	6577 Pinto Ct.	220	Open below 50 ft.	basalt	4.5
10736	8000 Olney	150	90-150	Basalt	100
10737	8388 Rocking Horse	230	140-220	Basalt	40
10738	8555 Aumsville hwy	160	Unknown	Basalt	14
10739	8666 Aumsville hwy.	222	unknown	Basalt	100
10740	7796 Nathan St.	152	111-151	Sandstone	66
10741	6884 76 th Ave.	247	204-244	Sandstone	62
10742	6426 Mustang Ct.	186	unknown	Basalt	35
10744	6607 Pinto Ct.	140	94-114	Basalt	14
10745	8380 Aumsville hwy.	200	unknown	Basalt	80
10749	6315 Mustang Ct.	140	Open at 50 ft.	Basalt	28
10754	6425 Mustang Ct.	330	Unknown	Basalt	2
10762	6893 76 th Ave.	170	155-170	Shale/Tuff	66
10816	Bronco St.	203	Open at 19 ft	Basalt	10
10829	8445 Aumsville Hwy	156	Unknown	Basalt	Unknown
17973	6446 Mustang Ct.	239	179-239	Basalt	70
18547	6172 Santiam Springs	165	65-165	Basalt	50
18826	6162 Santiam Springs	200	100-200	Basalt/Claystone	20
19046	6192 Santiam Springs	100	60-90	Basalt	25
10960	8676 Rocking Horse Rd. Initial log before deepening)	172	120-160	Basalt	20
19666	8355 Aumsville Hwy	165	Open at 53ft	Basalt	5
50567	7523 Olney	98	Open at 39ft.	Sandstone	20
51651	6182 Santim Springs	420	Open at 97ft.	Sandstone	5
53148	6430 Mustang Ct.	262	182-242	Basalt	18
59873	6715 76 th Ave.	110	90-110	Basalt	70
64063	8388 Rocking Horse Rd.	230	unknown	Basalt	40
64254	8676 Rocking Horse Rd.	242	202-237	Basalt	25
68138	6607 Pinto Ct.	450	44-55	Basalt	15

Note: Wells are also located on Figure 3

Table 2
Identified Well Logs
T8S/R2W, Section 24

Well No.	Address	Total Depth (ft)	Screened Area	Source Formation	Flow at time of installation (GPM)
8188	8447 Bronco	207	168-207	Basalt	40
10838	8520 Aumsville Hwy.	202	162-197	Basalt	30
10839	8445 Aumsville Hwy.	377	unknown	Sandstone	4.75
18509	8490 Aumsville Hwy	204	164-204	Basalt	30
52190	6151 Santiam Springs	163	Open at 39 ft.	Basalt	100
54135	8520 Aumsville Hwy.	220	Open at 19 ft.	basalt	40
60289	8547 Bronco Dr.	145	100-145	Sandstone	35
62765 (section 26)	8234 Olney	140	120-135	Basalt	15

Note: Wells are also located on Figure 3

In 1997, Northwest Geologic Services (NGS) completed a more detailed geologic and hydrogeologic study of residential acreage-zoned area underlain by the Columbia River Basalts and older rocks for the Marion County Community Development Department.

The study also examined the availability of ground water for future development for each section with zoned residential acreage. The amount of water available for future development was based on an estimated recharge volume that was compared to an estimated consumption volume. If consumption was less than 90% of the recharge volume then water was available for future development.

In 1998, the USGS produced two Professional Papers (1424-A and 1424-B) *Geologic framework of the Willamette lowland aquifer system, Oregon and Washington*, and *Hydrogeologic framework of the Willamette lowland aquifer system, Oregon and Washington* that covered this portion of the Willamette Valley.

The basalt aquifer was also discussed in Scientific Investigations Report 2005-5168 *Ground-Water Hydrology of the Willamette Basin, Oregon*.

2.1 Water use Inventory

This study covers a portion of Sections 23 and 24 in Township 8 South and Range 2 West. The conclusions were based on the assumption that all lots or parcels within the study area were developed with a well for domestic use. There are no water rights to consider in this study area.

A Water Use Inventory was completed by Marion County on July 16, 2019. The WUI has estimated that the additional well from the lot partition will bring the total proposed water use to

48.22 acre-feet per year, which is 48.22% of the available recharge. This figure is shown on Figure 2.

2.2 Hydrogeology Review for 8395 Aumsville Hwy.

In December of 2015, a hydrogeology review was completed for a property located at 8395 Aumsville highway. SE in Salem. This site is at the western edge of the study area that extends ¼ mile from our site. By using information from sources other than the NGS report, the author was able to show that the site passed the 90% threshold with a 73.5% usage of available water. A copy of the report with the figures, but minus the attachments, is found in Appendix C.

3.0 General Geology

The site is underlain by Neogene sediments that generally consist of sandy silts and occasional clay layers. These sediments are usually within 10-400 feet thick. The Neogene sediments overlie a very productive area of Columbia River Basalt that is the source of many of the wells in the area. There is an interfingering of sandstone and some shale in the east and north portions of the surrounding area.

4.0 General Hydrogeology of the Area

4.1 Geology and Hydrogeology of the Study Area

According to the USDA Soil Conservation Services. The surficial soils are Nekia Silty Clay Loam. This soil is formed from weathered basalt and tuffs. Ground water is found in the basalt below the Neogene sediments. Earlier studies have reported that the water bearing basalts are identified as the Silver Falls Basalt.

The general geologic map that is provided with the WUI indicates a fault that runs from the northwest to the southeast of the northern edge of the study area. It is essentially parallel to Hwy 22. The entire study area is found south of the reported fault. The water source for most of the wells in the area is from the basalt, but some sandstone has been found on top of the basalt layers in the eastern and northwestern portion of the area. This is shown in cross section A-A' Sandstone and shale generally underlie the basalt at a depth of 100-130 feet below grade.

According to USGS Scientific Investigations Report 2005-5168 "Ground Water Hydrology of the Willamette Basin, Oregon" ground water flow in the Columbia River basalt unit is to the northeast in this area.

Located well logs are found in Attachment A of this report. Cross Sections through the site are also included as Figures 4 and 5.

4.3 Review of Well Deepenings and Abandonments

Deepenings

For this review we looked at wells in both Section 23 and 24. There have been quite a few wells that have been deepened or abandoned in these sections. To look at the problems more in depth, we have put together tables for deepenings and abandonments in each section. Tables 3 and 4 are for deepenings in sections 23 and 24, and tables 5 and 6 are for abandonments in these sections as well. There are a total of 168 well logs in Section 23 that are not associated with well alterations, and 109 well log reports in Section 24.

Table 3
Well deepenings in Section 23

Well #	Address (if known)	Date deepened	Change in depth (ft)
10738	8555 Aumsville Hwy	August 1981	90-160
10739	8666 Aumsville Hwy.	July 1987	183-222 ft.
10741	6884 76 th Ave.	July 1987	103-247
10745	8380 Aumsville hwy.	August 1984	125-200
10747	8384 Aumsville hwy.	August 1984	153-215
10754	6425 Mustang Ct.	August 1981	264-330 dry hole
10829	NE quarter	August 1962	107-156
19690	6181 Walinda	July 1995	216-246
56886	8355 Aumsville Hwy	August 2002	165-361 dry hole
64254	8676 Rocking Horse Ln.	July 2012	162-242

Table 4
Well Deepenings in Section 24

Well #	Address (if known)	Date deepened	Change in depth (ft)
10833	8550 Aumsville hwy.	Sept 1987	100-230
10838	8520 Aumsville hwy	July 1985	91-202
10839	8445 Aumsville Hwy.	July 1985	151-377
10841	6134 Shaw Lane	July 1984	80-120
10844	5157 Dunmore	August 1981	83-191
10845	4847 Dunmore	August 1981	170-281
10849	8636 Aumsville	November 1976	145-220
10854	9032 Smith Rd.	October 1988	180-500
10871	unknown	May 1972	30-130
10882	unknown	November 1965	30-97
10900	NE/SE	October 1997	95-145
18509	8490 Aumsville Hwy.	July 1993	112-157
52241	6647 Pinto Ct.	August 1997	104-126
54681	8880 Aumsville Hwy.	February 2000	86-130
64063	8388 Rocking Horse Ln.	May 2012	220-230

As you can see from the tables, there was a rash of deepenings in the mid to late 1980's, particularly up along Aumsville Hwy. Within the last 20 years, there have been two deepenings in Section 23, and one of them was because of a dry hole. The other one was more recent, in 2012 and that one dropped the well from 162 to 424 feet.

In Section 24, other than wells along Aumsville Highway, the majority of the deepenings were significantly outside of our study area. The only wells that were deepened within the past 20 years was one on Aumsville and the well on Rocking Horse Lane that was only dropped an additional 10 feet. This does not appear to show that the water table has dropped much over the past two decades.

Abandonments

Table 5
Well abandonments Section 23

Well #	Address	Total Depth (ft.)	Date	Rationale
10778	Unknown	Hand dug, shallow	May 1975	Shallow, only needed 1 yard of concrete to fill
53612	SE/NW	300	November 1998	Low flow (2 gpm)
53869	Bethany St.	60	March 1999	Well in easement, not allowed
54323	Bethany St.	76	Sept 1999	Unknown
54324	Bethany St	100	Sept 1999	Unknown
59366	7533 Toms Way	220	November 2005	Could not remove coliform bacteria
64539	6268 76 th Ave.	164	November 2013	Unknown
66622	7974 Aumsville hwy.	110	December 2016	Damaged well casing

Table 6
Well abandonments, Section 24

Well #	Address	Total Depth (ft.)	Date	Rationale
10837	6149 Shaw Ln.	23	April 1987	Ordered by county for new building permit
17564	8555 Almsville Hwy.	56	November 1999	Dry hole
50533	8973 Shaw Square Rd.	unknown	May 1996	Unknown
52242	6447 Pinto Ct.	148	August 1997	Test hole

Based on the logs, these abandonments all seem to be based on conditions that are not associated with dropping water levels.

4.4 Long Term Water Level Data

Long Term well production in the area is monitored by state observation wells. The two nearest wells are well MARI 64328 in Section 23 and MARI 8971 in Section 30. The water levels in both wells appear to be stable, but neither of them have a long record. Well 64328 only has records from July 2014 through March 2019 and the record for 8917 runs from 1996 through 2001. While this isn't a significant record, it does show that portions of the aquifer in this area have had stable water levels for several years.

Both of these records, along with the associated well logs are found in Attachment B.

5.0 Water Rights.

There are no water rights in the area that is impacting out study area.

6.0 Estimate of Ground Water Budget

The County estimates a total acreage within the study area to be 411.45 acres. According to figure 5 of the NGS report, the site gets 53 inches of rain each year, which comes out to 4.41 feet of precipitation per year. If we assume that the recharge rate is 6%, that gives us 0.265 acre-feet per acre, or 109.03 acre-feet of recharge per year.

Consumptive Use

According to the WUI prepared by the county, when the proposed lot split takes place, it will add an additional 9 parcels to the area. This will bring the total parcels to 82 within the study area. Each parcel is assumed to use 525 gallons of ground water per day.

525 gallons per day for a year is 191625 gallons per year or 0.588 acre-feet per parcel (82 parcels) X (0.588 af) equals 48.26 acre-feet of consumption per year.

If we are using 48.26 acre-feet of water within the study area, and we get 109.03 acre-feet of infiltration, that means that adding the additional parcels will only bring the consumptive use up to 44.22 % of the available water.

7.0 Summary and Conclusions

The information developed during this Hydrogeologic Review has shown that there is ample water to allow for the lot split that has been requested by the lot split for Ms Smith. The Columbia River Basalt aquifer that is the source rock for wells in the area is quite productive, as shown in Table 1. Based on our calculations, only about 44.22% of the available water is being used at this time. With that in mind, we request that this lot split be approved.

8.0 Qualifications and Signature

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with customary principles and practices in the field of hydrology. This statement is in lieu of other statements either expressed or implied. I am not responsible for the independent conclusions, opinion or recommendations made by others based on the records review, site observations and field exploration presented in this report.

For hydrogeologic evaluations it is often necessary to use information prepared by others and I cannot be responsible for the accuracy of such information. Additionally, the passage of time

may result in a change in the geology or hydrogeology at this site and surrounding properties, This report does not warrant against future operations or conditions, nor does it warrant operations or conditions present of a type or at a location not investigated.

This report is intended for the use of and Marion County. This report may not be used or relied upon by any other party without the written consent of Tim O'Gara, RG. The scope of services performed in execution of the evaluation may not be appropriate to satisfy the needs of other users, and use or re-use of this document or the findings conclusions or recommendations is at the risk of said user.

Respectfully Submitted

Tim O'Gara, R.G.
Consulting Hydrogeologist

9.0 References

Northwest Geological Services Inc.- *Geologic and Hydrogeologic Study of the Residential Acreage-Zoned Areas of Marion County Underlain by the Columbia River Basalt and Older Rocks. 1997*

USGS Professional Paper 1424-A - *Geologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington.*

USGS Professional Paper 1424-B – *Hydrogeologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington*

USGS Scientific Investigations Report 2005-5168 – *Ground Water Hydrogeology of the Willamette Basin, Oregon*

Water well logs from Oregon Water Resources Department

Water Rights information from Oregon Water Resources Department

Historic Water Level data from Oregon Water Resources Department

Figures

Appendix A

Located Water Well Logs

Appendix B

Oregon Water Resources Department Hydrographs

Appendix C

Hydrogeology Review
For
8395 Aumsville Hwy SE.
Salem, OR