Groundwater Review Summary Form

Application # G- 18352

GW Reviewer DENNIS ORLOWSKI **Date Review Completed:** 4/19/2017

Summary of GW availability and Injury Review:

[ ] Groundwater for the proposed use is either over appropriated, will not likely be available in the amounts requested without injury to prior water rights, OR will not likely be available within the capacity of the groundwater resource per Section B of the attached review form.

Summary of Potential for Substantial Interference Review:

[ ] There is the potential for substantial interference per Section C of the attached review form.

Summary of Well Construction Assessment:

[ ] The well does not appear to meet current well construction standards per Section D of the attached review form. Route through Well Construction and Compliance Section.

This is only a summary. Documentation is attached and should be read thoroughly to understand the basis for determinations and for conditions that may be necessary for a permit (if one is issued).

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date **04/19/2017**

FROM: Groundwater Section **Dennis Orlowski**
Reviewer's Name

SUBJECT: Application G- **18352** Supersedes review of _____
Date of Review(s)

PUBLIC INTEREST PRESUMPTION; GROUNDWATER

OAR 690-310-130 (1) *The Department shall presume that a proposed groundwater use will ensure the preservation of the public welfare, safety and health as described in ORS 537.525.* Department staff review groundwater applications under OAR 690-310-140 to determine whether the presumption is established. OAR 690-310-140 allows the proposed use be modified or conditioned to meet the presumption criteria. **This review is based upon available information and agency policies in place at the time of evaluation.**

A. GENERAL INFORMATION: Applicant's Name: **All Wood Restoration (Munro)** County: **Clackamas**

A1. Applicant(s) seek(s) **0.130** cfs from **one** well(s) in the **Willamette River – AB Milk Creek** Basin, **Molalla River** subbasin

A2. Proposed use **Nursery (5.1 acres)** Seasonality: **Year round**

A3. Well and aquifer data (**attach and number logs for existing wells; mark proposed wells as such under logid**):

Well	Logid	Applicant's Well #	Proposed Aquifer*	Proposed Rate(cfs)	Location (T/R-S QQ-Q)	Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36
1	CLAC 12477	CLAC 12477	Alluvium	0.130	4S/1E-24 NE-NE	1070 ft S, 800 ft W from NE cor S 24

* Alluvium, CRB, Bedrock

Well	Well Elev ft msl	First Water ft bls	SWL ft bls	SWL Date	Well Depth (ft)	Seal Interval (ft)	Casing Intervals (ft)	Liner Intervals (ft)	Perforations Or Screens (ft)	Well Yield (gpm)	Draw Down (ft)	Test Type
1	200		6	10/20/1969	62	0-19	0-45	N/A	N/A	18	36	P

Use data from application for proposed wells.

A4. **Comments:** Applicant identified an existing domestic well drilled in 1969 (original owner: Everett White) as the proposed POA (Well 1). In May 2016 the current landowner applied for a well ID number and was assigned CLAC 12477. Well correlation for this review is based on tax lot, street address and TRS information provided on the well ID application, the original well log, and the water right application map prepared by a CWRE (PHG).

Well yield and drawdown information in Table A3 from well test recorded on original log in 1969.

Well 1 (CLAC 12477) log indicates open hole from 45-62 ft depth, with no gravel pack placement at any depth interval.

A5. ☒ **Provisions of the** Willamette Basin rules relative to the development, classification and/or management of groundwater hydraulically connected to surface water ☐ **are**, *or* ☒ **are not**, activated by this application. (Not all basin rules contain such provisions.)
Comments: Well 1 produces from an unconfined aquifer, but is greater than ¼ mile from the nearest stream, thus pertinent rules (OAR 690-502-240) do not apply.

A6. ☐ **Well(s) #** _____, _____, _____, _____, _____, tap(s) an aquifer limited by an administrative restriction.
Name of administrative area: _____
Comments: The well is not located within an administrative area.

B. GROUNDWATER AVAILABILITY CONSIDERATIONS, OAR 690-310-130, 400-010, 410-0070

B1. **Based upon available data**, I have determined that groundwater* for the proposed use:

a. ☐ **is** over appropriated, ☒ ***is not*** over appropriated, *or* ☐ **cannot be determined to be** over appropriated during any period of the proposed use. * This finding is limited to the groundwater portion of the over-appropriation determination as prescribed in OAR 690-310-130;

b. ☐ **will not** *or* ☐ **will** likely be available in the amounts requested without injury to prior water rights. * This finding is limited to the groundwater portion of the injury determination as prescribed in OAR 690-310-130;

c. ☐ **will not** *or* ☐ **will** likely to be available within the capacity of the groundwater resource; or

d. ☒ **will, if properly conditioned**, avoid injury to existing groundwater rights or to the groundwater resource:
   i. ☒ The permit should contain condition #(s) **7c (7-yrs of measurements), medium water-use reporting** ;
   ii. ☐ The permit should be conditioned as indicated in item 2 below.
   iii. ☐ The permit should contain special condition(s) as indicated in item 3 below;

B2. a. ☒ **Condition** to allow groundwater production from no deeper than **100** ft. below land surface;

b. ☐ **Condition** to allow groundwater production from no shallower than _____ ft. below land surface;

c. ☐ **Condition** to allow groundwater production only from the _____ groundwater reservoir between approximately_____ ft. and_____ ft. below land surface;

d. ☐ **Well reconstruction** is necessary to accomplish one or more of the above conditions. The problems that are likely to occur with this use and without reconstructing are cited below. Without reconstruction, I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Groundwater Section.

Describe injury –as related to water availability– that is likely to occur without well reconstruction (interference w/ senior water rights, not within the capacity of the resource, etc): _____

B3. **Groundwater availability remarks:** The proposed POA, Well 1 (CLAC 12477), is completed in Holocene alluvial deposits of the Molalla River system, at a near-middle portion of the Molalla Fan (Gannett and Caldwell, 1998). More specifically, the Well 1location is within the floodplain of the present-day Molalla River, which is located approximately 0.7 mile to the east-northeast. The Willamette Silt is not present in the area, having been eroded by the Molalla River system (Woodward and others, 1998).

Most nearby wells within the floodplain obtain groundwater from sand and gravel channel deposits of the ancestral Molalla River. Domestic and irrigation well density is low in the immediate floodplain area, but increases several miles up- and downstream of Well1. There are eight wells within one mile of Well 1; four of these tap water-bearing zones less than 100 ft deep, whereas the other four obtain water from about 120 to almost 450 ft bls. Reported yields for the shallower wells are low (20-60 gpm), but generally much higher for the deeper wells (up to ~500 gpm).

At and near the Well 1 location, a shallow and highly-permeable gravel and sand deposit is present beginning within several feet of ground surface and extending to about 30-40 feet depth. Consequently, local recharge from precipitation through the shallow gravel deposits to underlying sands and gravels tapped by area wells is likely relatively high.

Available data from nearby wells completed in the alluvium indicate that groundwater levels have been relatively stable for at least the past 20 years (see attached hydrograph). Generally stable groundwater levels, localized high recharge rates, and currently low well density suggest that groundwater will be available at the requested allocation.

C. GROUNDWATER/SURFACE WATER CONSIDERATIONS, OAR 690-09-040

C1. **690-09-040 (1):** Evaluation of aquifer confinement:

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	**Alluvium**	☐	☒

Basis for aquifer confinement evaluation: Aquifer conditions at the Well 1 location are assumed to be generally unconfined. Well 1 (existing CLAC 12477) obtains water from a cemented sand unit from 47-59 ft depth. This sand unit is overlain by 17 feet of clay and silt from 30 to 47 ft bls, which in turn is overlain by 25 feet of sandy gravel that extends upward to near ground surface.

Rationale for assumed unconfined conditions:

1) Review of nearby well logs indicates the clay/silt unit reported at Well 1/CLAC 12477 is not laterally extensive in the area (typical of this type of fluvial depositional environment).
2) The typically extensive and confining Willamette Silt is not present at the well location or anywhere within this portion of the Molalla River floodplain (Woodward and others, 1998).
3) Numerous nearby ponds/reservoirs that have been excavated into, and some possibly entirely through, the shallow gravel and sands from ~5 ft to 30 ft bls (discussed in Section C6) likely promote the hydraulic connection between these near-surface deposits and the deeper cemented sands tapped by Well 1 (and thus leading to generally unconfined conditions).

C2. **690-09-040 (2) (3):** Evaluation of distance to, and hydraulic connection with, surface water sources. All wells located a horizontal distance less than ¼ mile from a surface water source that produce water from an unconfined aquifer shall be assumed to be hydraulically connected to the surface water source. Include in this table any streams located beyond one mile that are evaluated for PSI.

Well	SW #	Surface Water Name	GW Elev ft msl	SW Elev ft msl	Distance (ft)	Hydraulically Connected? YES	NO	ASSUMED	Potential for Subst. Interfer. Assumed? YES	NO
1	**1**	**Molalla River**	**190**	**170-200**	**3800**	☒	☐	☐	☐	☒
1	**2**	**Unnamed tributary to Gribble Creek**	**190**	**210-220**	**5600**	☒	☐	☐	☐	☒

Basis for aquifer hydraulic connection evaluation: In the Willamette Valley lowlands, groundwater typically discharges from alluvial aquifer systems to larger streams in the area, such as the Molalla River. However, smaller streams such as Gribble Creek and its tributaries that are not fully incised through the Willamette Silt do not have an efficient hydraulic connection to the underlying aquifer due to the low vertical permeability of the silt (the Willamette Silt is reportedly 30 to 40 ft thick in the Gribble Creek area, whereas it is not present in the Molalla River floodplain (Woodward and others, 1998; Conlon and others, 2003, 2005)).

Well 1/SW 1: Well 1 and SW1 (Molalla River) are considered to be hydraulically connected because groundwater and surface water elevations in the nearest stream reach are very similar. Also, the absence of the Willamette Silt within the floodplain likely enhances the hydraulic connection between the shallow aquifer at Well 1 and the river.

Well 1/SW 2: Well 1 and SW2 (unnamed tributary to Gribble Creek) are considered to be hydraulically connected because groundwater and surface water elevations are somewhat similar. However, SW2 flows on top of the Willamette Silt, which impedes flow between the stream and the underlying alluvial aquifer, thus reducing the efficiency of the hydraulic connection. Furthermore, because Well 1 is closer to SW1 (Molalla River) the well's cone of depression cannot expand to SW2 (Gribble Creek) if it can capture all of the water it needs from SW1.

Water Availability Basin the well(s) are located within:

SW1: Molalla R > Willamette R – above Milk Cr
SW2: Molalla R>Willamette R – at mouth

C3a. **690-09-040 (4):** Evaluation of stream impacts for each well that has been determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. Limit evaluation to instream rights and minimum stream flows that are pertinent to that surface water source, and not lower SW sources to which the stream under evaluation is tributary. Compare the requested rate against the 1% of 80% *natural* flow for the pertinent Water Availability Basin (WAB). If Q is not distributed by well, use full rate for each well. Any checked ☒ box indicates the well is assumed to have the potential to cause PSI.

Well	SW #	Well < ¼ mile?	Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
1	**1**	☐	☐	**IS70747A**	**78.70**	☐	**54.50**	☐	**2.9**	☐

C3b. **690-09-040 (4):** Evaluation of stream impacts by total appropriation for all wells determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. **Complete only if Q is distributed among wells**. Otherwise same evaluation and limitations apply as in C3a above.

	SW #		Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
			☐			☐		☐		☐

Comments:

C3a: Instream water right IS70747A has variable monthly flow requirements; flow shown in Table C3a is lowest of monthly flows (August). No surface water availability in WAB June through November.

Interference between proposed POA/Well 1 and the Molalla River was estimated using the Hunt 1999 stream depletion model (Hunt, 1999). Aquifer thickness (50 ft) was calculated assuming a static groundwater level of 10 ft bls and the bottom of the water-bearing sand unit at Well 1 at approximately 60 ft bls. Aquifer hydraulic conductivity values ranged from 50 to 250 to 1000 ft/day, corresponding to 'silty sand' to 'sand with gravel' as reported in the literature (Freeze and Cherry, 1979) (available pumping test data from nearby wells is sparse and generally not applicable because most of the wells tap deeper formations of different composition). Pumping was set at the maximum requested rate for year-round use as a worse-case scenario.

C3b: not applicable

C4a. **690-09-040 (5):** Estimated impacts on **hydraulically connected surface water sources greater than one mile** as a percentage of the proposed pumping rate. Limit evaluation to the effects that will occur up to one year after pumping begins. This table encompasses the considerations required by 09-040 (5)(a), (b), (c) and (d), which are not included on this form. Use additional sheets if calculated flows from more than one WAB are required.

Non-Distributed Wells Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
Distributed Wells Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
(A) = Total Interf.													
(B) = 80 % Nat. Q													
(C) = 1 % Nat. Q													

(D) = (A) > (C)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(E) = (A / B) x 100	%	%	%	%	%	%	%	%	%	%	%	%

(A) = total interference as CFS; (B) = WAB calculated natural flow at 80% exceed. as CFS; (C) = 1% of calculated natural flow at 80% exceed. as CFS; (D) = highlight the checkmark for each month where (A) is greater than (C); (E) = total interference divided by 80% flow as percentage.

Basis for impact evaluation:

Potential depletion of SW 2 (unnamed tributary to Gribble Creek) was not evaluated because the results of the SW1 analysis (Section 3a), which has a relatively more-efficient hydraulic connection with Well 1, indicated very low depletion at 30 days of pumping. Because the hydraulic connection with SW2 is much less efficient (see Section C2 discussion), potential stream depletion there would be even less than that estimated for SW1.

C4b. **690-09-040 (5) (b) The potential to impair or detrimentally affect the public interest is to be determined by the Water Rights Section.**

C5. ☐ **If properly conditioned**, the surface water source(s) can be adequately protected from interference, and/or groundwater use under this permit can be regulated if it is found to substantially interfere with surface water:

i. ☐ The permit should contain condition #(s)_____;

ii. ☐ The permit should contain special condition(s) as indicated in "Remarks" below;

C6. **SW / GW Remarks and Conditions:** In addition to SW1 and SW2, there are several permitted surface water reservoirs near the proposed POA/Well 1 (CLAC 12477). The nearest of these is only about 150 feet north of Well 1, and is authorized by certificate 34429 for storage of 3.0 acre-feet of water for fish culture purposes. Four other storage reservoirs associated with certificate 38804, also for fish culture, are located from about 900 to 2000 ft south and southeast of Well 1.

It is possible that pumping of the proposed POA/Well 1 could affect water stored in the nearest reservoir associated with certificate 34429. Shallow groundwater depths (elevation 190 ft msl, ~10 ft bls at Well 1) also suggest that the reservoirs intersect the shallow aquifer system. However, this possible interference cannot be confirmed because construction details of the reservoirs (e.g., depth, bottom material) is unknown.

References Used:

Conlon, T.D., Wozniak, K.C., Woodcock, D., Herrera, N.B., Fisher, B.J., Morgan, D.S., Lee, K.K., and Hinkle, S.R., 2005, Ground-water hydrology of the Willamette Basin, Oregon: U.S. Geological Survey Scientific Investigations Report 2005-5168.

Conlon, T.D., Lee, K.K., and Risley, J.R., 2003, Heat tracing in streams in the central Willamette Basin, Oregon, *in* Stonestrom, D.A. and Constantz, Jim, eds., Heat as a tool for studying the movement of groundwater near streams: U.S. Geological Survey Circular 1260, chapter 5, p. 29-34.

Gannett, M.W. and Caldwell, R., 1998, Geologic framework of the Willamette Lowland aquifer system, Oregon and Washington: U.S. Geological Survey Professional Paper 1424-A, 32 p.

Hunt, B., 1999, Unsteady stream depletion from ground water pumping: Ground Water, v. 37, no. 1, p. 98-102.

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

Woodward, D.G., Gannett, M.W., and Vaccaro, J.J., 1998, Hydrogeologic framework of the Willamette Lowland aquifer system, Oregon and Washington: U.S. Geological Survey Professional Paper 1424-B, 82 p.

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** _____ **Logid:** _____

D2. **THE WELL does not appear to meet current well construction standards based upon:**

a. ☐ review of the well log;
b. ☐ field inspection by _____;
c. ☐ report of CWRE _____;
d. ☐ other: (specify) _____

D3. **THE WELL construction deficiency or other comment is described as follows:** _____

D4. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.**

Water Availability Tables

Oregon Water Resources Department
Water Availability Analysis

Main Help Return Contact Us

Water Availability Analysis
Detailed Reports

MOLALLA R > WILLAMETTE R - AB MILK CR
WILLAMETTE BASIN
Water Availability as of 10/6/2016

Watershed ID #: 70747 (Map)
Date: 10/6/2016

Exceedance Level: 80%
Time: 2:01 PM

Water Availability Calculation | Consumptive Uses and Storages | Instream Flow Requirements | Reservations | Water Rights | Watershed Characteristics

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	531.00	1.28	530.00	0.00	300.00	230.00
FEB	541.00	1.27	540.00	0.00	300.00	240.00
MAR	569.00	1.30	568.00	0.00	300.00	268.00
APR	591.00	1.57	589.00	0.00	300.00	289.00
MAY	466.00	4.87	461.00	0.00	300.00	161.00
JUN	207.00	6.85	200.00	0.00	200.00	0.15
JUL	85.90	12.10	73.80	0.00	100.00	-26.20
AUG	55.70	9.81	45.90	0.00	78.70	-32.80
SEP	54.50	4.00	50.50	0.00	88.90	-38.40
OCT	90.40	1.38	89.00	0.00	166.00	-77.00
NOV	273.00	1.25	272.00	0.00	300.00	-28.30
DEC	560.00	1.29	558.00	0.00	300.00	259.00
ANN	454,000.00	2,850.00	451,000.00	0.00	165,000.00	287,000.00

Oregon Water Resources Department
Water Availability Analysis

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Water Availability Analysis
Detailed Reports

MOLALLA R > WILLAMETTE R - AB MILK CR
WILLAMETTE BASIN
Water Availability as of 10/6/2016

Watershed ID #: 70747 (Map)
Date: 10/6/2016

Exceedance Level: 80%
Time: 2:03 PM

Water Availability Calculation | Consumptive Uses and Storages | Instream Flow Requirements | Reservations | Water Rights | Watershed Characteristics

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

Application #	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
IS70747A	CERTIFICATE	300.00	300.00	300.00	300.00	300.00	200.00	100.00	78.70	88.90	166.00	300.00	300.00
Maximum		300.00	300.00	300.00	300.00	300.00	200.00	100.00	78.70	88.90	166.00	300.00	300.00

Oregon Water Resources Department
Water Availability Analysis

Main Help Return Contact Us

Water Availability Analysis
Detailed Reports

MOLALLA R > WILLAMETTE R - AT MOUTH
WILLAMETTE BASIN
Water Availability as of 4/19/2017

Watershed ID #: 66796 (Map)
Date: 4/19/2017

Exceedance Level: 80%
Time: 9:42 AM

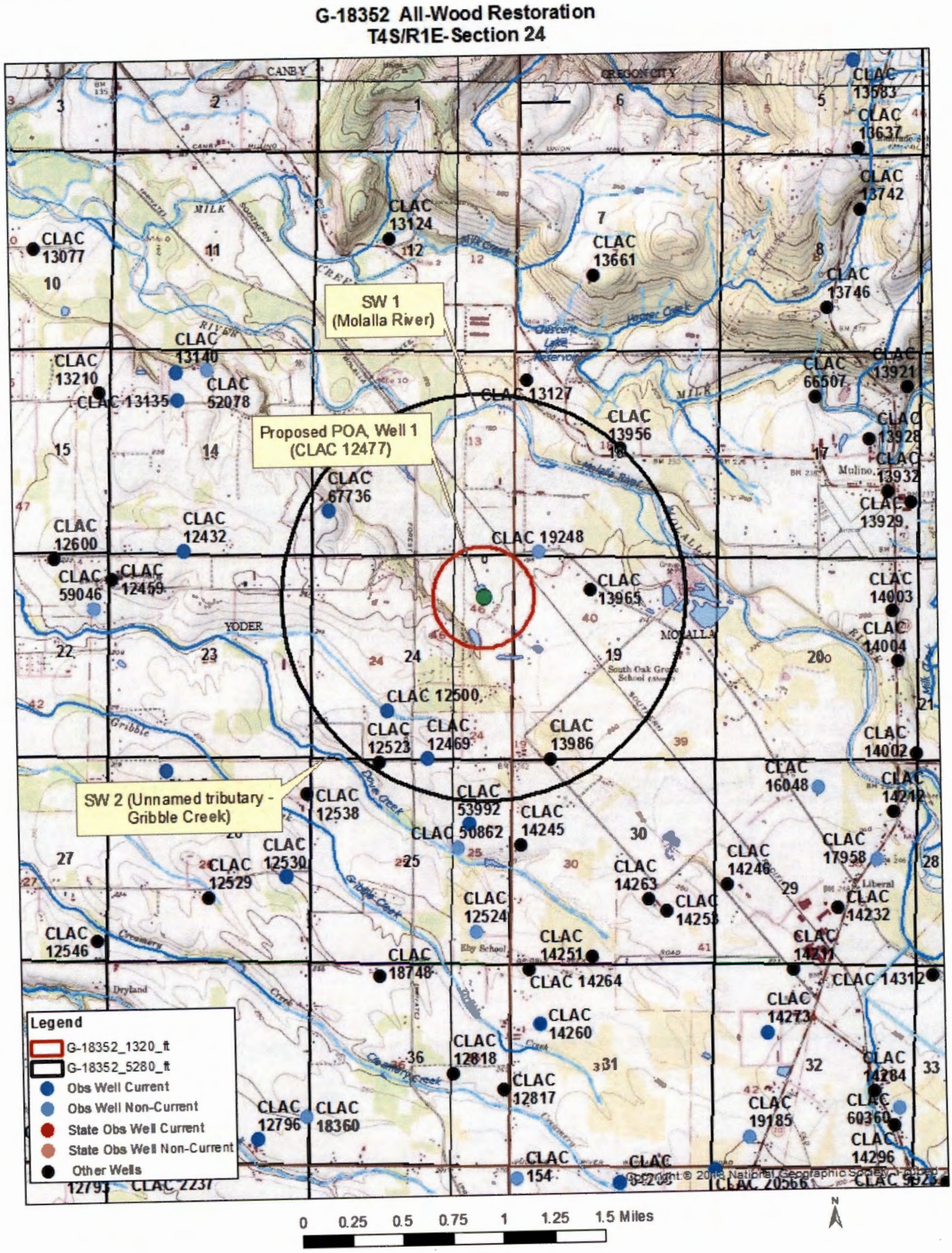
Water Availability Calculation | Consumptive Uses and Storages | Instream Flow Requirements | Reservations | Water Rights | Watershed Characteristics

Water Availability Calculation

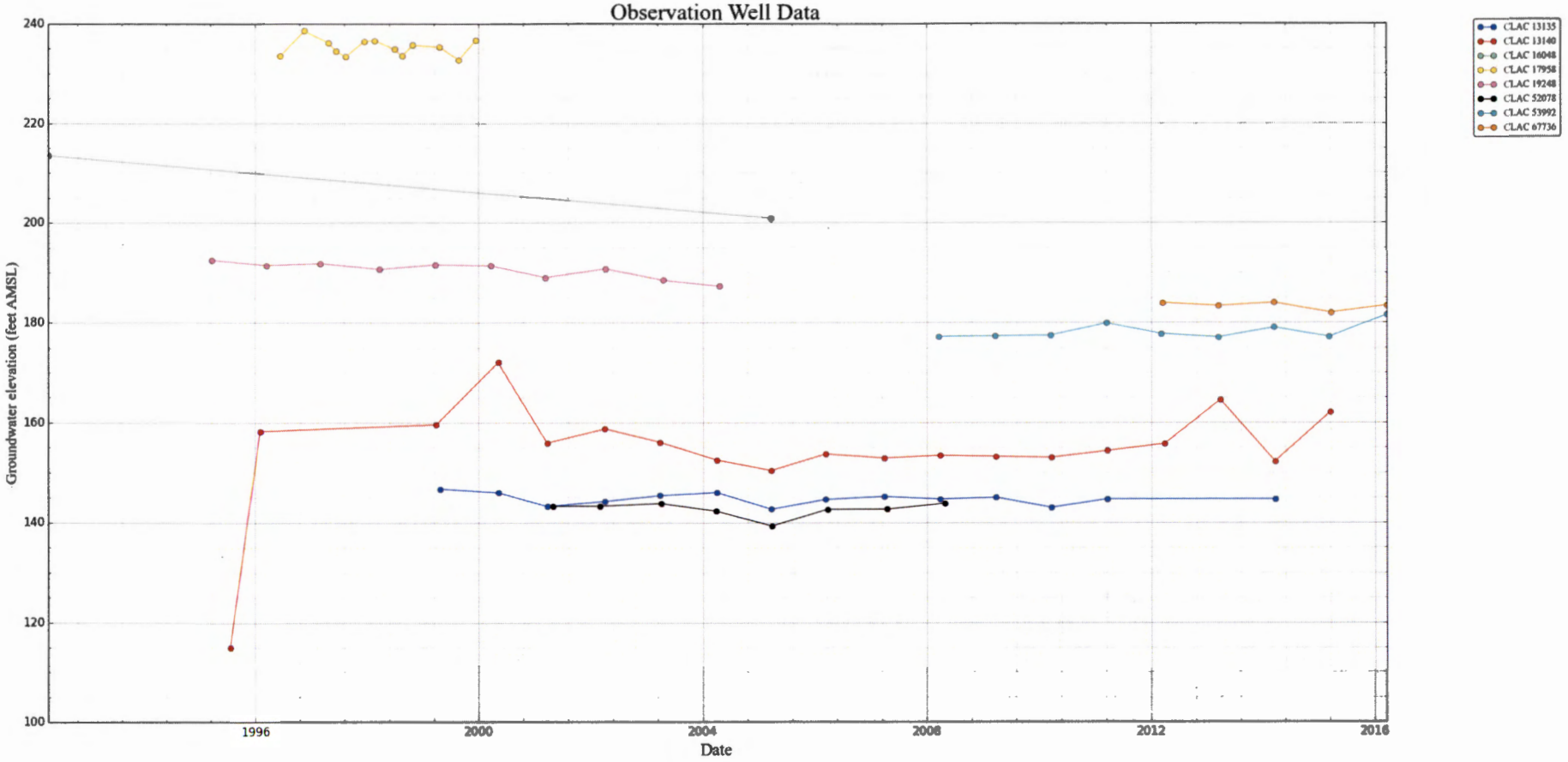
Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	1,870.00	153.00	1,720.00	0.00	500.00	1,220.00
FEB	2,010.00	143.00	1,870.00	0.00	500.00	1,370.00
MAR	1,830.00	111.00	1,720.00	0.00	500.00	1,220.00
APR	1,530.00	84.60	1,450.00	0.00	500.00	945.00
MAY	927.00	95.00	832.00	0.00	500.00	332.00
JUN	431.00	116.00	315.00	0.00	500.00	-185.00
JUL	204.00	180.00	24.30	0.00	200.00	-176.00
AUG	139.00	151.00	-12.00	0.00	100.00	-112.00
SEP	134.00	80.00	54.00	0.00	150.00	-96.00
OCT	188.00	38.30	150.00	0.00	450.00	-300.00
NOV	637.00	78.60	558.00	0.00	500.00	58.40
DEC	1,700.00	148.00	1,550.00	0.00	500.00	1,050.00
ANN	1,320,000.00	63,200.00	1,240,000.00	0.00	295,000.00	967,000.00

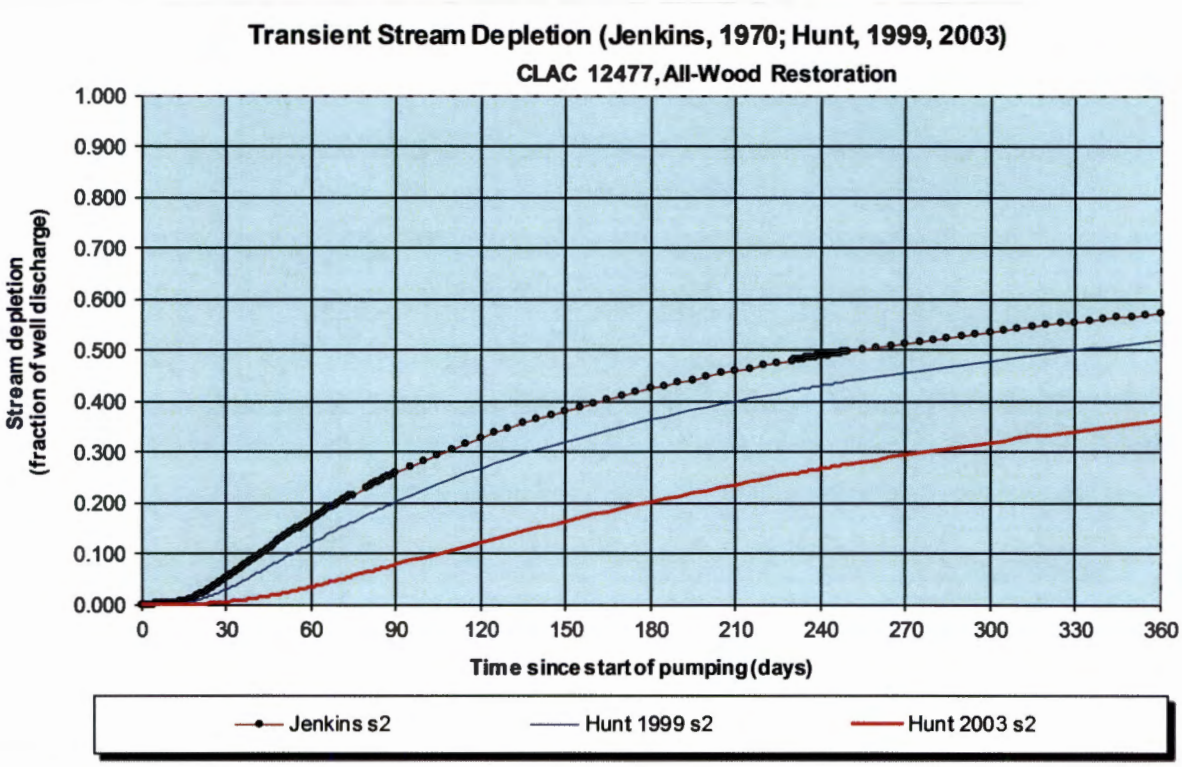
Well Location Map



Water-Level Trends in Nearby Wells



Stream Depletion Model Output



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 365 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	5.0%	16.5%	25.7%	32.7%	38.0%	42.3%	45.8%	48.8%	51.3%	53.5%	55.4%	57.1%
H SD 1999	2.9%	11.9%	20.1%	26.7%	31.9%	36.3%	39.9%	42.9%	45.6%	47.9%	49.9%	51.8%
H SD 2003	0.48%	3.40%	7.75%	12.18%	16.33%	20.12%	23.54%	26.62%	29.38%	31.87%	34.12%	36.17%
Qw, cfs	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
H SD 99, cfs	0.004	0.015	0.026	0.035	0.042	0.047	0.052	0.056	0.059	0.062	0.065	0.067
H SD 03, cfs	0.001	0.004	0.010	0.016	0.021	0.026	0.031	0.035	0.038	0.041	0.044	0.047

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	0.13	0.13	0.13	cfs
Time pump on (pumping duration)	tpon	365	365	365	days
Perpendicular from well to stream	a	3800	3800	3800	ft
Well depth	d	62	62	62	ft
Aquifer hydraulic conductivity	K	50	250	1000	ft/day
Aquifer saturated thickness	b	50	50	50	ft
Aquifer transmissivity	T	2500	12500	50000	ft*ft/day
Aquifer storativity or specific yield	S	0.2	0.2	0.2	
Aquitard vertical hydraulic conductivity	Kva	1	1	1	ft/day
Aquitard saturated thickness	ba	17	17	17	ft
Aquitard thickness below stream	babs	3	3	3	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	140	140	140	ft
Streambed conductance (lambda)	sbc	46.666667	46.666667	46.666667	ft/day
Stream depletion factor	sdf	1155.200000	231.040000	57.760000	days
Streambed factor	sbf	70.933333	14.186667	3.546667	
input #1 for Hunt's Q_4 function	t'	0.000866	0.004328	0.017313	
input #2 for Hunt's Q_4 function	K'	339.764706	67.952941	16.988235	
input #3 for Hunt's Q_4 function	epsilon'	1.000000	1.000000	1.000000	
input #4 for Hunt's Q_4 function	lamda'	70.933333	14.186667	3.546667	