

3/27, 2015

SUBJECT: Scenic Waterway Interference Evaluation

The source of appropriation is within or above a Scenic Waterway

Use the Scenic Waterway condition (condition 7J)

____ Per ORS 390.835, the Groundwater Section is unable to calculate groundwater interference with surface water that contributes to a scenic waterway; therefore, the Department is unable to find that there is a preponderance of evidence that the proposed use will measurably reduce the surface flows necessary to maintain the free-flowing character of a scenic waterway.

Calculate interference as the monthly fraction of the annual consumptive use and fill in the table below. If interference cannot be calculated, per criteria in 390.839, do not fill in the table but check the "unable" option above, thus informing the Water Rights Section that the Department is unable to make a Preponderance of Evidence finding.

Exercise of this permit is calculated to reduce monthly flows in the _____ Scenic Waterway by the following amounts, expressed as a proportion of the annual consumptive use pumped from the well.

[illegible]

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date 3/27/2015

FROM: Groundwater Section Gerald H. Grondin (Darrick E. Boschmann)
Reviewer's Name

SUBJECT: Application G- 17921 Supersedes review of N.A.
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 ground water 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: Robert & Carla M Sanders County: Harney

A1. Applicant(s) seek(s) 4.42* cfs from 2 well(s) in the Malheur Lake Basin,
Catlow Valley subbasin Quad Map: Frenchglen

A2. Proposed use: Irrigation (250 acres primary) Seasonality: **April 15th to October 15th (184 days)

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	Proposed	PWELL RS-S1	Bedrock	***2.23	32/32-29 NW-NE	****/ 1280'S, 2185'W fr NE cor S 29
2	Proposed	PWELL RS-S2	Bedrock	***1.7	32/32-29 NW-SE	****/ 13290'S, 2215'W fr NE cor S 29
3						
4						
5						

* 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	4579	?	?	?	900	?	?	?	?	?	?	?
2	4578	?	?	?	900	?	?	?	?	?	?	?

Use data from application for proposed wells.

A4. Comments:

The proposed wells are in Harney County in the northern Catlow Valley, about 5 miles southwest of the town of Frenchglen. The area is surficially mapped as Qal (alluvium) by Evans and Geisler (2001). Underlying the Quaternary deposits at an unknown depth are Tertiary welded tuffs and basalt bedrock. Based on local well logs it is likely that, at the proposed depth, the proposed wells will penetrate through the predominantly basin fill unit into the underlying predominantly volcanic/basalt bedrock.

***Note:** The total maximum rate requested on the application is 1985 gpm (4.42 cfs) which is more than the 1/80th cfs/acre that is typically allowed (250/80 = 3.125 cfs). Additionally, the application requests an annual volume of 1263 acre-feet, which is more than the 3 acre-feet per acre that is typically allowed for irrigation of 250 acres (250 x 3 = 750 AF).

****Note:** The period of use requested on the application is April 15th to October 15th (184 days), which is not the typical irrigation season for this area of March 1st to October 31st (245 days). This review assumes the period of use requested in the application was the intent of the applicant.

*****Note:** The sum of the well specific rates listed for the two proposed wells totals 3.93 cfs, which is again more than the 1/80th cfs/acre that is typically allowed (250/80 = 3.125 cfs). Additionally, the total of the well specific rates listed is not equivalent to the total maximum rate requested of 4.42 cfs.

******Note:** The metes and bounds for all wells provided on the application map are denoted as feet 'TO' instead of feet 'FROM' the referenced corner. These values are adjusted in the table above to reflect the standard notation of feet 'FROM' the referenced corner.

Note: The metes and bounds provided on the application map for proposed Well 1 indicate SE corner Section 20 as the reference corner, which puts the proposed well in a location that is inconsistent with what is indicated on the map. For the purposes of this review it is assumed that this was an incorrect reference corner. It appears the applicant inadvertently used the intersection of the section line with the tax lot boundary (MapTaxlot 32S32E000001103) for the reference corner. The metes and bounds cited in the table above are approximated based on the application map, and are used for the purposes of this review.

Note: The metes and bounds provided on the application map for proposed Well 2 indicate NE corner Section 29 as the reference corner, which puts the proposed well in a location that is inconsistent with what is indicated on the map. For the purposes of this review it is assumed that this was an incorrect reference corner. It appears the applicant inadvertently used the intersection of the section line with the tax lot boundary (MapTaxlot 32S32E000001103) for the reference corner. The metes and bounds cited in the table above are approximated based on the application map, and are used for the purposes of this review.

- A5. ☒ **Provisions of the Malheur Lake** Basin rules relative to the development, classification and/or management of ground water hydraulically connected to surface water ☐ are, or ☒ are not, activated by this application. (Not all basin rules contain such provisions.)

Comments: _____

OAR 690-512-0040

The rule states: "(1) Except as provided in section (3) of this rule, the Department shall not accept an application for permit, or issue a permit, for any use of surface water, or of groundwater the use of which has the potential to substantially interfere with surface water, in the Malheur Lake Basin unless the applicant shows, by a preponderance of evidence, that unappropriated water is available to supply the proposed use at the times and in the amounts requested. The evidence provided shall be prepared by a qualified hydrologist or other water resources specialist and shall include:

(a) Streamflow measurements of gage records from the source or, for use of groundwater, the stream in hydraulic connection with the source; or

(b) An estimate of water availability from the source or, for use of groundwater, the stream in hydraulic connection with the source which includes correlations with streamflow measurements or gage records on other, similar streams and considers current demands for water affecting the streamflows."

This review does not find a potential for substantial interference with surface water.

- A6. ☐ **Well(s) #** _____, _____, _____, _____, _____, tap(s) an aquifer limited by an administrative restriction.

Name of administrative area: _____

Comments: _____

Currently no administrative area. _____

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

B1. **Based upon available data**, I have determined that ground water* 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 ground water 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 ground water 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 ground water resource; or
- d. ☒ **will, if properly conditioned**, avoid injury to existing ground water rights or to the ground water resource:
 - i. ☒ The permit should contain condition #(s) 7B, 7F, 7N, 7P, 7, 7K, flow meter;
 - 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 ground water production from no deeper than _____ ft. below land surface;
 - b. ☐ **Condition** to allow ground water production from no shallower than _____ ft. below land surface;
 - c. ☐ **Condition** to allow ground water production only from the _____ ground water 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 Ground Water 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. **Ground water availability remarks:** _____

There are two State Observation Wells in the Catlow Valley. The state observation well with long term data closest to the proposed wells is State Observation Well 1151 (HARN 900) located in T33S/R31E-sec 8ac; about 7 miles from the proposed wells; which has a period of record from 1987-2014. The other is State Observation Well 1150 (HARN 1683) located in T33S/R31E-sec 31ddc; about 10 miles southwest from the proposed wells; which has a period of record from 1987-2008. Water level trends in both wells indicate some level of decline over the period of record (see attachment); however the relative contribution of climate and groundwater withdrawals to this decline cannot be determined. Notably however, state observation well 1151 (HARN 900) is in proximity to an area of relatively higher groundwater pumpage, and records a somewhat greater overall decline.

The proposed wells under this application are in the vicinity of existing groundwater rights. The potential increase in drawdown at the closest permitted POD to the proposed wells (POD 2 for file G-17582; priority date 9/4/2012) resulting from pumping of the proposed wells was calculated using the Theis Equation (see attachments). At the requested well specific rates, over the requested period of use (184 days), the results show a combined drawdown of 17.45 feet. The transmissivity used in this calculation is the maximum transmissivity derived from specific capacity data from wells in nearby sections (6,000 ft²/day; see attachment). When a more intermediate transmissivity value is used (3000 ft²/day), the results show a combined drawdown of 28.77 feet. Additionally, if the entire duration of the typical irrigation season for this area is used (245 days), the calculated drawdown is correspondingly higher.

B1.b.: Due to the pumping rates and annual volumes requested, permit condition 7N is recommended if this permit is issued (see below). Condition 7N states that "The water user shall discontinue use of, or reduce the rate of or volume of withdrawal from, the well(s) if...Hydraulic interference leads to a decline of 25 or more feet in any neighboring well with senior priority." The calculations cited above indicate that interference with the closest permitted POD to the proposed wells (POD 2 for file G-17582; priority date 9/4/2012) will be very near or over 25 feet, which could automatically trigger condition 7N.

If a permit is issued, the following conditions are recommended:

7B: Interference Condition

7F: Proposed Well location Condition

7N: Annual Measurement and Decline Condition

7P: Well Tag Condition

7T: Dedicated Measuring Tube Condition for all POA wells

Flow meter condition: Use the water rights "large" permit condition requiring a totalizing flow meter and reporting

7K: The proposed wells shall be constructed to develop groundwater only from the predominantly volcanic/basalt bedrock unit underlying the predominantly basin fill unit. The wells shall be continuously cased and continuously sealed a minimum of five (5) feet into the predominantly volcanic/basalt bedrock beneath the predominantly basin fill unit. The wells may not be completed in such a manner that they allow ground water to be developed from the overlying basin fill. If during well construction, it becomes apparent that the wells can be constructed to eliminate interference with nearby shallow wells or hydraulically connected streams in a manner other than specified in this permit, the permittee can contact the Department Hydrogeologist for this permit or the Ground Water/Hydrology Section Manager to request approval of such construction. The request shall be in writing, and shall include a rough well log and a proposed construction design for approval by the Department. The request can be approved only if it is received and reviewed prior to placement of any permanent casing and sealing material. If the well is constructed first and then the request made, requested modification will not be approved. The new well depth and construction specifications will be incorporated into any certificate issued for this permit.

Special Permit Condition:

The permittee shall construct one (1) minimum six-inch diameter observation well to penetrate the same aquifer as the production wells. The well shall meet the Department's minimum well construction standards and shall be cased and sealed to the same depth as the production wells. The well shall be constructed at a location approved by the Department for the purpose of instrumentation with continuous water-level monitoring equipment. The landowner or permittee shall provide access to Department staff to install and maintain the monitoring equipment. The well shall not be used for any other purpose while the Department is monitoring water levels. The well shall be completed prior to water use under the terms of any permit issued.

C. GROUND WATER/SURFACE WATER CONSIDERATIONS, OAR 690-09-040**C1. 690-09-040 (1):** Evaluation of aquifer confinement:

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	bedrock	☐	☒
2	bedrock	☐	☒
		☐	☐
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation: _____

Some local well logs report static water levels that are somewhat above the depth that groundwater was first encountered. It is unknown however how continuous any overlying fine grained material is, and given the minimal head difference reported in local well logs it is likely that the regional aquifer is unconfined to weakly semiconfined.

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 (mi)	Hydraulically Connected?			Potential for Subst. Interfer. Assumed?	
						YES	NO	ASSUMED	YES	NO
All	1	Roaring Springs	4480±	4635	~7 mi	☐	☒	☐	☐	☒
All	2	Rock Creek	4480±	4588	~14 mi	☐	☒	☐	☐	☒
All	3	Donner und Blitzen R.	4480±	4190-4825	~6 mi	☐	☒	☐	☐	☒
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation: _____

This evaluation considers perennial reaches of surface water only (see memo by Ivan Gall, 1/15/2008).

The groundwater elevation cited above is derived from the 7/6/2013 static water level reported on the water well report for HARN 51967 located in 32S/31E-25.

According to Waring (1909) Roaring Springs "come forth well up on the face of the scarp, not from the edge of the valley alluvium as they would if they rose along fault fissures." Further, Waring notes that these springs "issue from a coarse tuffaceous bed". These observations suggest that the source water for these springs is likely from recharge on the slopes of Steens Mountain to the east, rather than from groundwater flow from within the Catlow Valley.

The nearest perennial reach of Rock Creek is the sink of this stream located ~14 miles to the west. At this location the elevation of Rock Creek is well above the estimated groundwater elevation at the location of the proposed wells. Groundwater at the proposed locations does not appear to provide baseflow to this reach of Rock Creek.

The Donner und Blitzen River is located to the northeast across a hydrologic surface water divide separating the Catlow Valley from the Blitzen Valley, and ultimately, Malheur Lake. The gentle west/northwest dips of the volcanic rock strata at this divide are one indication that a groundwater divide may also exist here. It is not known with certainty whether a groundwater divide does exist here, but until data becomes available to demonstrate otherwise, it is assumed that this is the case.

Water Availability Basin the well(s) are located within: No WAB data available.

- 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?
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
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		☐	☐			☐		☐		☐

- 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./C3b. No analysis here. All wells are more than 1 mile from perennial reaches of hydraulically connected surface water.

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
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Well Q as CFS													
Interference CFS													
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Interference CFS													
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Well Q as CFS													

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 ground water use under this permit can be regulated if it is found to substantially interfere with surface water:
- ☐ The permit should contain condition #(s) _____;
 - ☐ The permit should contain special condition(s) as indicated in "Remarks" below;

C6. SW / GW Remarks and Conditions

C1. 690-09-040 (1)

It is determined that all wells will produce water from an unconfined aquifer.

C2. 690-09-040 (2) (3)

It is determined that all wells are not hydraulically connected to Roaring Springs, Rock Creek, or the Donner und Blitzen River.

C3a./C3b. No analysis here. All wells are more than 1 mile from perennial reaches of hydraulically connected surface water.

C4a. 690-09-040 (5)

No analysis. There is no WAB data available. Additionally, available data indicate that Roaring Springs, Rock Creek, and the Donner und Blitzen River do not appear to be hydraulically connected to groundwater at the proposed wells. Further, other surface water bodies in the vicinity of the proposed POA well are intermittent, and lie at elevations well above the groundwater

If a permit is issued, the following conditions are recommended:

7B: Interference Condition

7F: Proposed Well location Condition

7N: Annual Measurement and Decline Condition

7P: Well Tag Condition

7T: Dedicated Measuring Tube Condition for all POA wells

Flow meter condition: Use the water rights "large" permit condition requiring a totalizing flow meter and reporting

7K: The proposed wells shall be constructed to develop groundwater only from the predominantly volcanic/basalt bedrock unit underlying the predominantly basin fill unit. The wells shall be continuously cased and continuously sealed a minimum of five (5) feet into the predominantly volcanic/basalt bedrock beneath the predominantly basin fill unit. The wells may not be completed in such a manner that they allow ground water to be developed from the overlying basin fill. If during well construction, it becomes apparent that the wells can be constructed to eliminate interference with nearby shallow wells or hydraulically connected streams in a manner other than specified in this permit, the permittee can contact the Department Hydrogeologist for this permit or the Ground Water/Hydrology Section Manager to request approval of such construction. The request shall be in writing, and shall include a rough well log and a proposed construction design for approval by the Department. The request can be approved only if it is received and reviewed prior to placement of any permanent casing and sealing material. If the well is constructed first and then the request made, requested modification will not be approved. The new well depth and construction specifications will be incorporated into any certificate issued for this permit.

Special Permit Condition:

The permittee shall construct one (1) minimum six-inch diameter observation well to penetrate the same aquifer as the production wells. The well shall meet the Department's minimum well construction standards and shall be cased and sealed to the same depth as the production wells. The well shall be constructed at a location approved by the Department for the purpose of instrumentation with continuous water-level monitoring equipment. The landowner or permittee shall provide access to Department staff to install and maintain the monitoring equipment. The well shall not be used for any other purpose while the Department is monitoring water levels. The well shall be completed prior to water use under the terms of any permit issued.

References Used: _____

Evans, J. G., & Geisler, T. M. (2001). Geologic field-trip guide to Steens Mountain Loop Road. *Harney County, Oregon: US Geological Survey and US Department of the Interior.*

OWRD water well reports, water level data, and/or hydrographs

Walker, G.W., and Repenning, C.A., 1965, Reconnaissance geologic map of the Adel quadrangle, Lake, Harney, and Malheur Counties, Oregon: U.S. Geological Survey, Miscellaneous Geologic Investigations Map I-446, scale 1:250,000

Waring, Gerald Ashley, 1909, Geology and water resources of the Harney Basin region, Oregon: Govt. Print. Off., Water Supply Paper 231, 93 p.

Memo by Ivan Gall, 1/15, 2008

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.**

Transmissivity from Specific Capacity

Transmissivity from Specific Capacity using the Theis Equation
(Adapted from Vorhis (1979))

Application: G-17921

Basin: Malheur lake

Theis Equation:

$$T = [Q/(4 * s * \pi)] [W(u)]$$

$$u = (r^2 * S)/(4 * T * t)$$

$$W(u) = (-\ln u) - (0.5772157) + (u/1 * 1!) - (u^2/2 * 2!) + (u^3/3 * 3!) - (u^4/4 * 4!) + \dots$$

T = transmissivity (L²/T) s = drawdown (L) r = radial distance (L) S = storage coefficient (dimensionless) t = time (T) pi = 3.141592654 u = dimensionless
W(u) = well function

Note: Transmissivity is derived using an iterative process. The calculations use a known or assumed Storage Coefficient (S) provided by the user. Specific Capacity (Q/s) is used to first approximate the Transmissivity (T) used to calculate u in the first Theis equation iteration. The Transmissivity of the previous iteration is used to calculate u in a given Theis equation iteration. Total Theis Equation iterations = 25 iterations. Can accept answer if difference in calculated Transmissivity (T(diff)) for the last 2 iterations is < 0.0001. Can accept answer if u in the last iteration is < 7.1

Note: Well efficiency is not included in the calculations

Note: An intermediate storage coefficient of 0.001 is used in all calculations.

References:

Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground water storage. American Geophysical Union Transactions, 16 annual meeting, vol. 16, pg. 519-524.
Vorhis, R.C. 1979. Transmissivity from pumped well data. Well Log, National Water Well Association newsletter, vol. 10, no. 11, Dec. 1979, pg. 50-52.

SPECIFIC CAPACITY CALCULATION

Well Log ID	Pumping Rate (Q) (gpm)	Drawdown (s) (ft)	Specific Capacity (gpm/ft)
HARN 1677	1850	85	21.7647
HARN 1668	1350	170	7.9412
HARN 910	1600	147	10.8844
HARN 1843	800	140	5.7143
HARN 50623	900	203	4.4335
HARN 51959	2400	130	18.4615

MIN: 4.43

MAX: 21.76

AVE: 11.53

STDEV: 7.07

TRANSMISSIVITY/HYDRAULIC CONDUCTIVITY CALCULATION

Well Log ID	T/R-S Q-Q	Time (t) (hours)	Well Diameter (d) (inches)	T (diff)	u	Transmissivity (T) (ft ² /day)	Transmissivity (T) (gpd/ft)
HARN 1677	33/31-4	36	16	0.0000E+00	1.26E-08	5871.66	43923.05
HARN 1668	33/31-9	24	16	0.0000E+00	5.67E-08	1959.54	14658.35
HARN 910	33/31-8	40	16	0.0000E+00	2.35E-08	2832.38	21187.70
HARN 1843	33/31-9	24	16	0.0000E+00	8.06E-08	1379.30	10317.89
HARN 50623	33/31-4	13	16	0.0000E+00	2.04E-07	1007.15	7534.02
HARN 51959	33/31-9	5	16	0.0000E+00	1.23E-07	4336.54	32439.60

Note:

MIN: 1007.15 7534.02

MAX: 5871.66 43923.05

AVE: 2897.76 21676.77

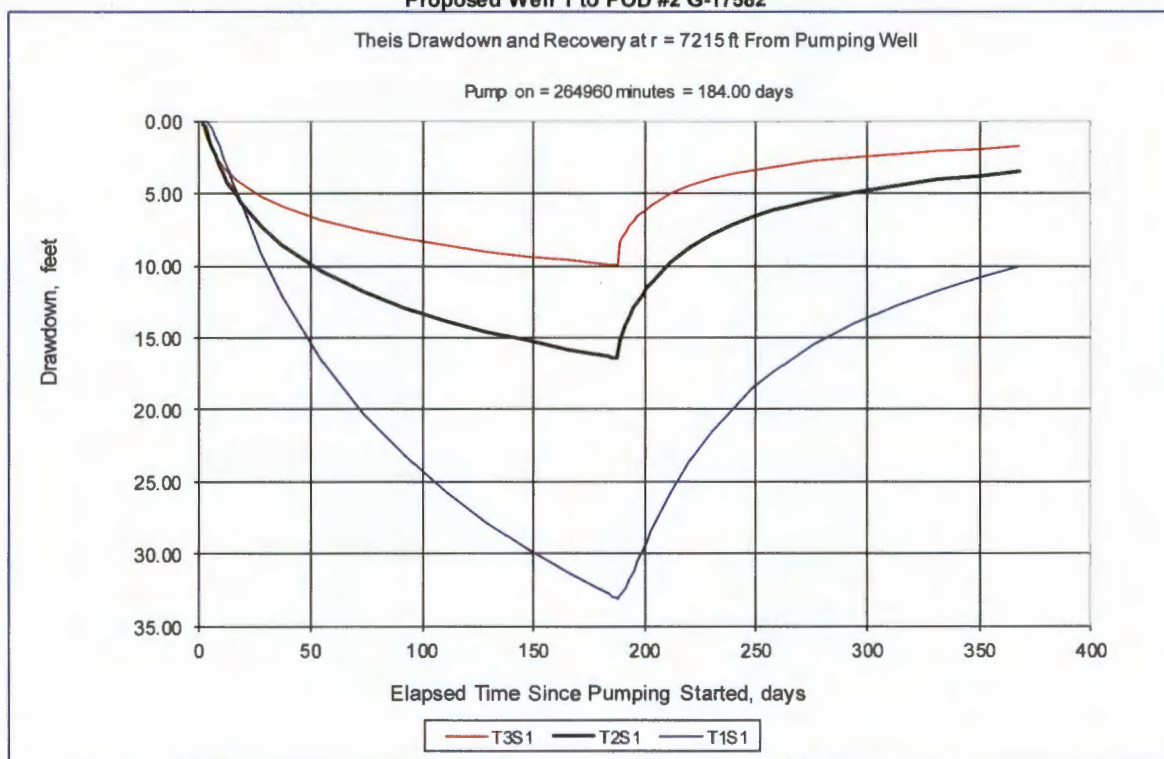
STDEV: 1880.36 14066.09

Theis Time-Drawdown Worksheet v.3.00

Calculates Theis nonequilibrium drawdown and recovery from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.
 Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units	
Total pumping time	t		184		d	
Radial distance from pumped well:	r		7215.00		ft	Q conversions
Pumping rate	Q		2.23		cfs	1,000.82 gpm
Hydraulic conductivity	K	40	120	240	ft/day	2.23 cfs
Aquifer thickness	b		25		ft	133.80 cfm
Storativity	S 1		0.00100			192,672.00 cfd
	S 2		0.00100			4.42 af/d
Transmissivity Conversions	T ft ² /pd	1,000	3,000	6,000	ft ² /day	
	T ft ² /pm	0.6944	2.0833	4.1667	ft ² /min	
	T gpd/pft	7,480	22,440	44,880	gpd/ft	

Recalculate Use the Recalculate button if recalculation is set to manual

Proposed Well 1 to POD #2 G-17582

Max Drawdown T1S1: 33.11 feet

Max Drawdown T2S1: 16.42 feet

Max Drawdown T3S1: 9.95 feet

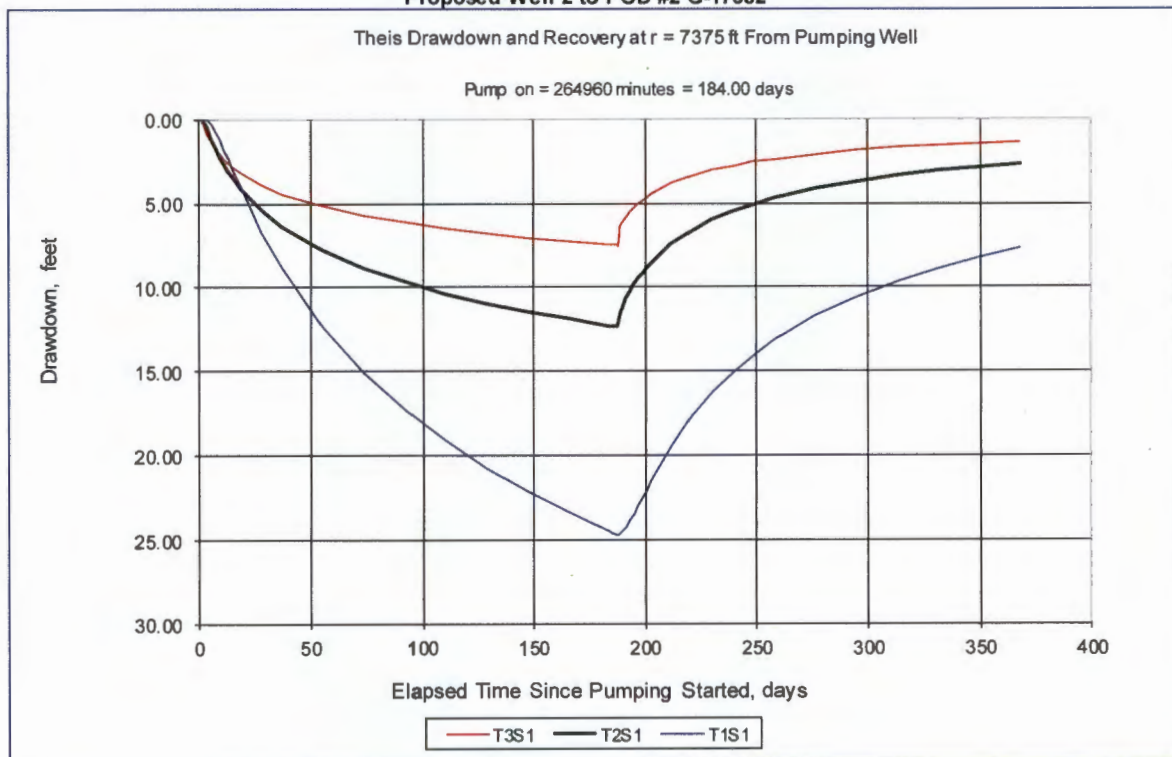
Theis Time-Drawdown Worksheet v.3.00

Calculates Theis nonequilibrium drawdown and recovery from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.
Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

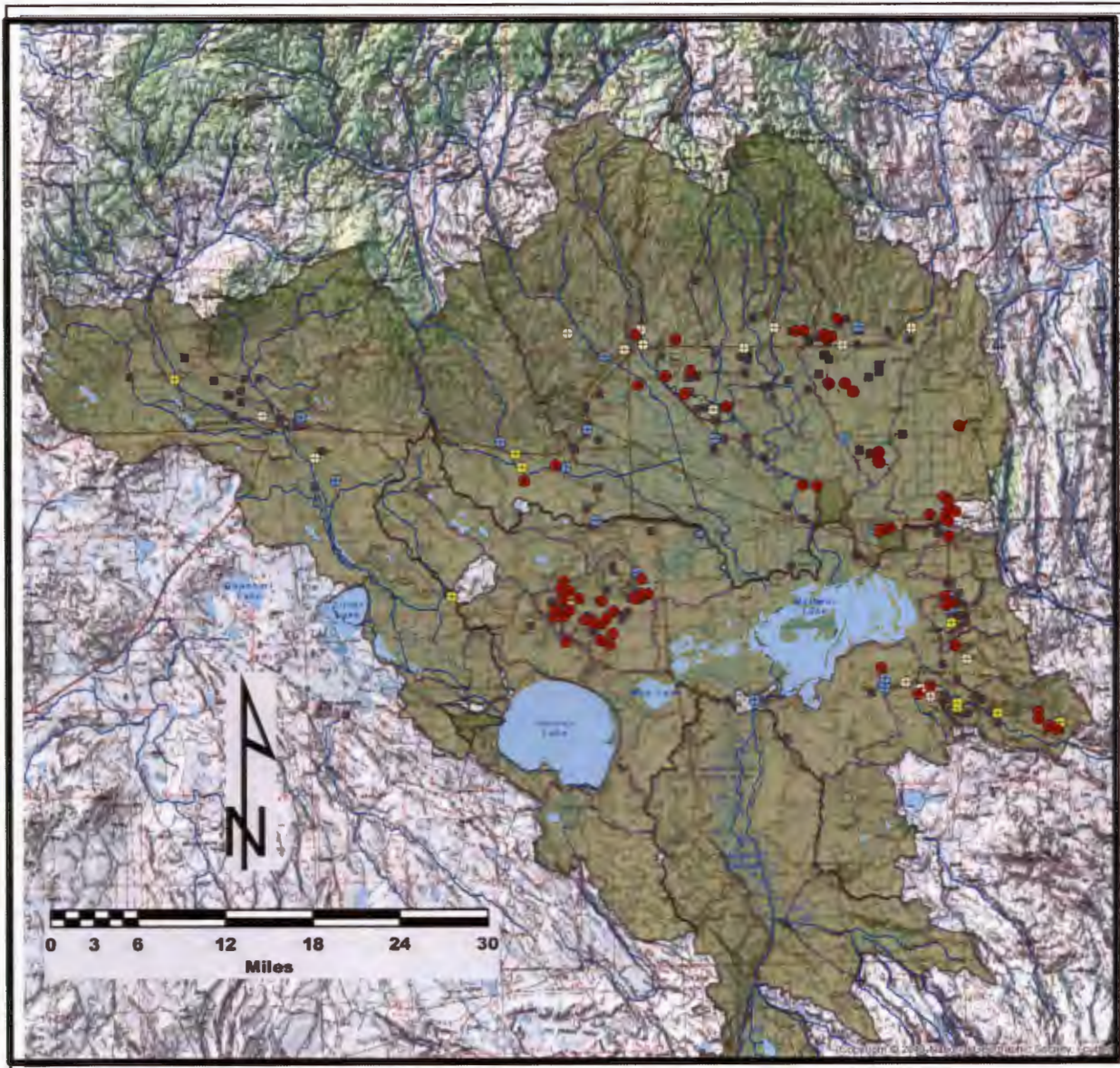
Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units	
Total pumping time	t		184		d	
Radial distance from pumped well:	r		7375.00		ft	Q conversions
Pumping rate	Q		1.70		cfs	762.96 gpm
Hydraulic conductivity	K	40	120	240	ft/day	1.70 cfs
Aquifer thickness	b		25		ft	102.00 cfm
Storativity	S 1		0.00100			146,880.00 cfd
	S 2		0.00100			3.37 af/d
Transmissivity Conversions	T f2pd	1,000	3,000	6,000	ft ² /day	
	T f2pm	0.6944	2.0833	4.1667	ft ² /min	
	T gpdft	7,480	22,440	44,880	gpd/ft	

Recalculate

Use the Recalculate button if recalculation is set to manual

Proposed Well 2 to POD #2 G-17582**Max Drawdown T1S1: 24.77 feet****Max Drawdown T2S1: 12.35 feet****Max Drawdown T3S1: 7.50 feet**





Greater Harney Valley Groundwater Level Trends

Plate Greater Harney Valley Area

Gerald H. Grondin
Oregon Water Resources Department
March 2015

Legend

- Harney_Valley_GW_Trend_Wells_post_1990s_data_decline
- Harney_Valley_GW_Trend_Wells_post_1990s_data_no_decline
- ⊕ Harney_Valley_GW_Trend_Wells_post_1990s_data_uncertain_trend
- ⊕ Harney_Valley_GW_Trend_Wells_pre_2000_data_only
- Located Wells
- Harney_Valley_wab_areas
- Harney_Valley_hydro_unit_areas_(no_wab)