

OK. 

MEMO

To: Kristopher Byrd, Well Construction and Compliance Section Manager
From: Joel Jeffery, Well Construction Program Coordinator
Subject: Review of Water Right Application G-18327
Date: December 12, 2016

The attached application was forwarded to the Well Construction and Compliance Section by Water Rights. Aurora Bouchier reviewed the application. Please see Aurora's Groundwater Review and the Well Logs.

Applicant's Well #1 (MARI 2068): Based on a review of the Well Report, Applicant's Well #1 appears to protect the groundwater resource.

The construction of Applicants Well #1 may not satisfy hydraulic connection issues.

Applicant's Well #2 (MARI 2105): Based on a review of the Well Report, Applicant's Well #2 does not appear to comply with current minimum well construction standards (See OAR 690 Division 210). The annular seal material, puddled clay, is not an approved grout. In order to meet minimum well construction standards the well must be resealed with an approved grout to a minimum depth of 18 feet below ground surface.

My recommendation is that the Department **not issue** a permit for Applicant's Well #2 (MARI 2105) unless it is brought into compliance with current minimum well construction standards or information is provided showing that it is in compliance with current minimum well construction standards.

Bringing Applicant's Well #2 into compliance with minimum well construction standards may not satisfy hydraulic connection issues.

Applicant's Well #3 (MARI 65739): Based on a review of the Well Report, Applicant's Well #3 appears to protect the groundwater resource.

The construction of Applicant's Well #3 may not satisfy hydraulic connection issues.

Groundwater Review Summary Form

Application # G- 18327

GW Reviewer Aurora Bouchier Date Review Completed: 4/15/2016

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:

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

Summary of Well Construction Assessment:

[X] 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 November 15, 2016
 FROM: Groundwater Section Aurora C Bouchier
 Reviewer's Name
 SUBJECT: Application G- 18327 Supersedes review of na
 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: Treco Investments LLC/Brent Smith County: Marion

A1. Applicant(s) seek(s) 0.73 cfs from 3 well(s) in the Willamette Basin,
Molalla-Pudding subbasin

A2. Proposed use Irrigation (58.6 acres) Seasonality: March 1 – October 31

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	MARI 2068 **	1	Alluvium	0.73 ¹	5S/1W-29 SE-SW	1200' N, 3750' W fr SE cor S 29
2	MARI 2105	2	Alluvium	0.73 ²	5S/1W-30 SE-NE	940' S & 460' E fr SE cor, LOT 1, S30
3	MARI 65739	3	Alluvium	0.73 ³	5S/1W-32 SE-NW	1920' S, 1795' E fr NW cor S 32

* 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	149	?	13	4/25/1978	363	0-22	+2'6" – 228'7", +2'5" – 232'7"	Na	16" casing: 107-207, 8" casing: 152-212	?		
2	166	39	22	6/4/1958	140	0-20	0-121	Na	90-117	?		
3	147	?***	37	6/17/2015	299	0-65	+1.5-153	128.5-148.5, 180-198, 294-299	148-180, 198-294	1200	53	P

Use data from application for proposed wells.

A4. **Comments:** **Note in application reads "Well 1 was constructed with 2 separate casings side-by-side within the borehole." The second casing (6 inch) is labeled as a gravel feed on the well log and is likely not for production.

*** There is a sealed off water bearing zone from 18-37 feet, but no static water level was measured for this interval. The log says all sand and gravel layers were water bearing. The well is sealed to a depth of 65 feet with the first sand and gravel layer below the seal listed at 79 – 86 feet (described as being cemented). It is difficult to determine if the seal is holding.

¹Well 1 is authorized under Inchoate T 11837 (1.31 cfs primary irrigation split between 3 wells and 0.69 cfs supplemental irrigation) and Certificate 89886 RR (0.16 cfs split between 2 wells) – if all authorized water was produced at this well the stacking would sum to 2.89 cfs.

²Well 2 is authorized under Certificate 30611 (0.69 cfs), Inchoate T 11837 (1.31 cfs primary irrigation split between 3 wells and 0.09 cfs commercial) and Certificate 89886 RR (0.16 cfs split between 2 wells) – if all authorized water was produced at this well the stacking would sum to 2.82 cfs.

³Well 3 is authorized under Inchoate T 11837 (1.31 cfs primary irrigation split between 3 wells) – if all authorized water was produced at this well the stacking would sum to 2.04 cfs.

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: Although these three well logs are not clear-cut, based on additional well logs in the area and published water table maps, it is likely that the wells are producing from a confined aquifer. Therefore, the pertinent rules (OAR 690-502-0240) do not apply.

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

Name of administrative area: _____

Comments: _____

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) 7N, Large 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 _____ 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 alluvial 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:** _____

Over 900 feet of alluvial sediments occur beneath land surface in the vicinity of the proposed POAs (Gannett et al, 1998). The water table occurs approximately 20-30 feet below land surface in this region (Conlon et al., 2005, and Woodward et al., 1998). Productive sand and gravel beds occur throughout the sequence separated layers of lower permeability silts and clay which progressively confine deeper water-bearing zones (Gannett and Caldwell, 1998, and Woodward et al., 1998).

State Observation Well 253 (MARI 2666) is located approximately 1.7 miles west, and State Observation Well 165 (MARI 3054) is located approximately 1.9 miles southwest. The hydrograph of the nearby State Observation Wells show relatively stable long-term trends for alluvial wells in the vicinity of the proposed POAs , with approximately 4-f feet of decline since the mid 1960's - although the seasonal fluctuation may be increasing. This possible increased seasonal fluctuation in groundwater level, plus increased groundwater development in the area, indicates a need for additional water-level monitoring (7N) if this permit is issued.

There is a note in the application that reads "It is understood that the OWRD will likely make a finding that there will be the Potential for Substantial Interference with the Pudding River from the proposed groundwater use. The applicant has an existing surface water right on the property and is willing to propose cancellation of part or all of the surface water right to mitigate for the estimated impacts to the surface water.

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	Alluvial	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Alluvial	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Alluvial	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>

Basis for aquifer confinement evaluation: Based on well logs in the area (MARI 2105, MARI 18349) and published water table maps (Conlon et al., 2005, and Woodward et al, 1998), it is likely that the wells are producing from a confined aquifer.

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?			Potential for Subst. Interfer. Assumed?	
						YES	NO	ASSUMED	YES	NO
1	1	Pudding river	~136	105-120	650	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	1	Pudding River	~144	105-120	2560	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	1	Pudding River	~110	105-120	2330	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1	2	Farmers Ck/Sam Brown Ck	~144	110-124	1950	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	2	Farmers Ck/Sam Brown Ck	~110	110-124	970	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Basis for aquifer hydraulic connection evaluation: Published water-table maps indicate that groundwater in the alluvial aquifer flows toward, and discharges to, the Pudding River and its perennial tributaries (Woodward et al., 1998 Plate 1, and Conlon et al., 2005, Plate 1). Head data from MARI 2105 and nearby wells corroborate this. However, there is a layer of low permeability Willamette Silt between the aquifer and the bottom of the surface water bodies, so the connection is likely inefficient. Farmers Creek and Sam Brown Creek join together and enter the Pudding River as a single tributary, therefore they are treated as a single entity for this analysis.

Water Availability Basin the well(s) are located within: 151: PUDDING R> MOLALLA R- AB MILL CR

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Na	Na	<input type="checkbox"/>	67.30	<input checked="" type="checkbox"/>	<<25%	<input checked="" type="checkbox"/>
2	1	<input type="checkbox"/>	<input type="checkbox"/>	Na	Na	<input type="checkbox"/>	67.30	<input checked="" type="checkbox"/>	<<25%	<input type="checkbox"/>
3	1	<input type="checkbox"/>	<input type="checkbox"/>	Na	Na	<input type="checkbox"/>	67.30	<input checked="" type="checkbox"/>	<<25%	<input type="checkbox"/>
1	2	<input type="checkbox"/>	<input type="checkbox"/>	Na	Na	<input type="checkbox"/>	Na	<input type="checkbox"/>	<<25%	<input type="checkbox"/>
3	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Na	Na	<input type="checkbox"/>	Na	<input type="checkbox"/>	<<25%	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>

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?
		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>

Comments: The wells closest to the streams (Well 1 for the Pudding River, and Well 3 for the Creeks) was modeled at the full proposed rate (not the stacked rate). The stream depletion at 30 days was estimated using the Hunt 2003 model. The presence of low permeability Willamette Silt between the aquifer and the beds of the streams result in an inefficient connection between the aquifer and the streams. Therefore, the stream depletion at 30 days is likely to be << 25%.

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													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
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: _____

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 the area surrounding the wells, about 80 feet of Willamette Silt overly the alluvium aquifer (Gannett and Caldwell, 1998). The Pudding River and other small streams are not completely incised through the Willamette Silt. In general, the silt has a low vertical hydraulic conductivity that will lower the efficiency the interchange of water between these streams and the alluvial aquifer.

References Used: _____
Application file: G-18321, and nearby G-15815, G-16061, and G-17965.

Conlon, Terrence D., Wozniak, Karl C., Woodcock, Douglas, Herrera, Nora B., Fisher, Bruce J., Morgan, David S., Lee, Karl K., and Hinkle, Stephen R., 2005, Ground-Water Hydrology of the Willamette Basin, Oregon: U.S. Geological Survey Scientific Investigations Report 2005-5168.

Gannett, Marshall W., and Caldwell, Rodney R., 1998, Geologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington: U. S. Geological Survey Professional Paper 1424-A.

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

Woodward, Dennis BG., Gannett, Marshall W., and Vaccaro, John J., 1998 Hydrogeologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington: U. S. Geological Survey Professional Paper 1424-B.

Nearby well logs and water level data, specifically: MARI 2068, MARI 2105, MARI 65739, MARI 18439, MARI 2666, and MARI 3054.

D. WELL CONSTRUCTION, OAR 690-200

D1. Well #: 2 Logid: MARI 2105

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:** Puddled Clay used as seal

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

Water Availability Tables

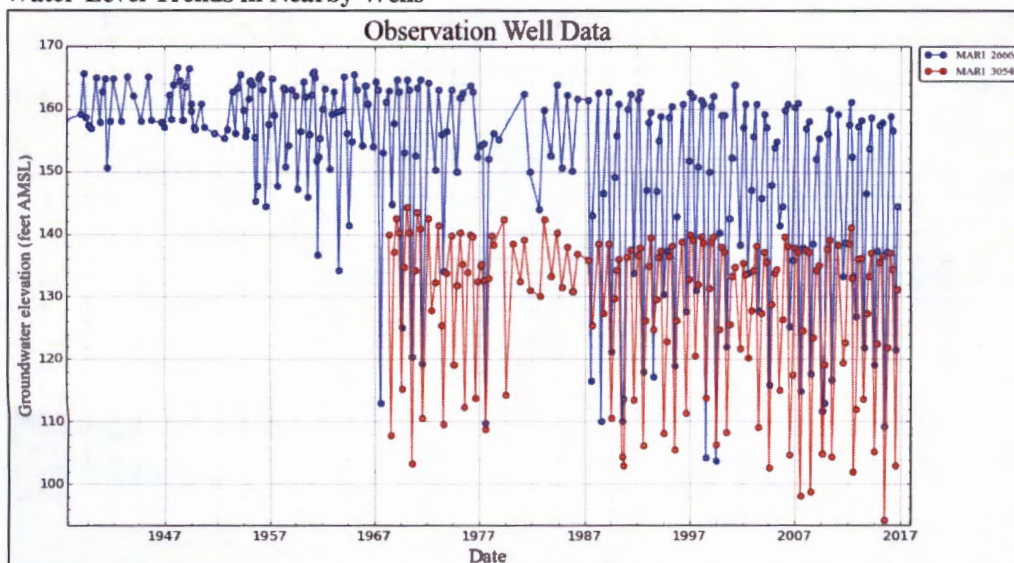
DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION

PUDDING R > MOLALLA R - AB MILL CR
Basin: WILLAMETTE

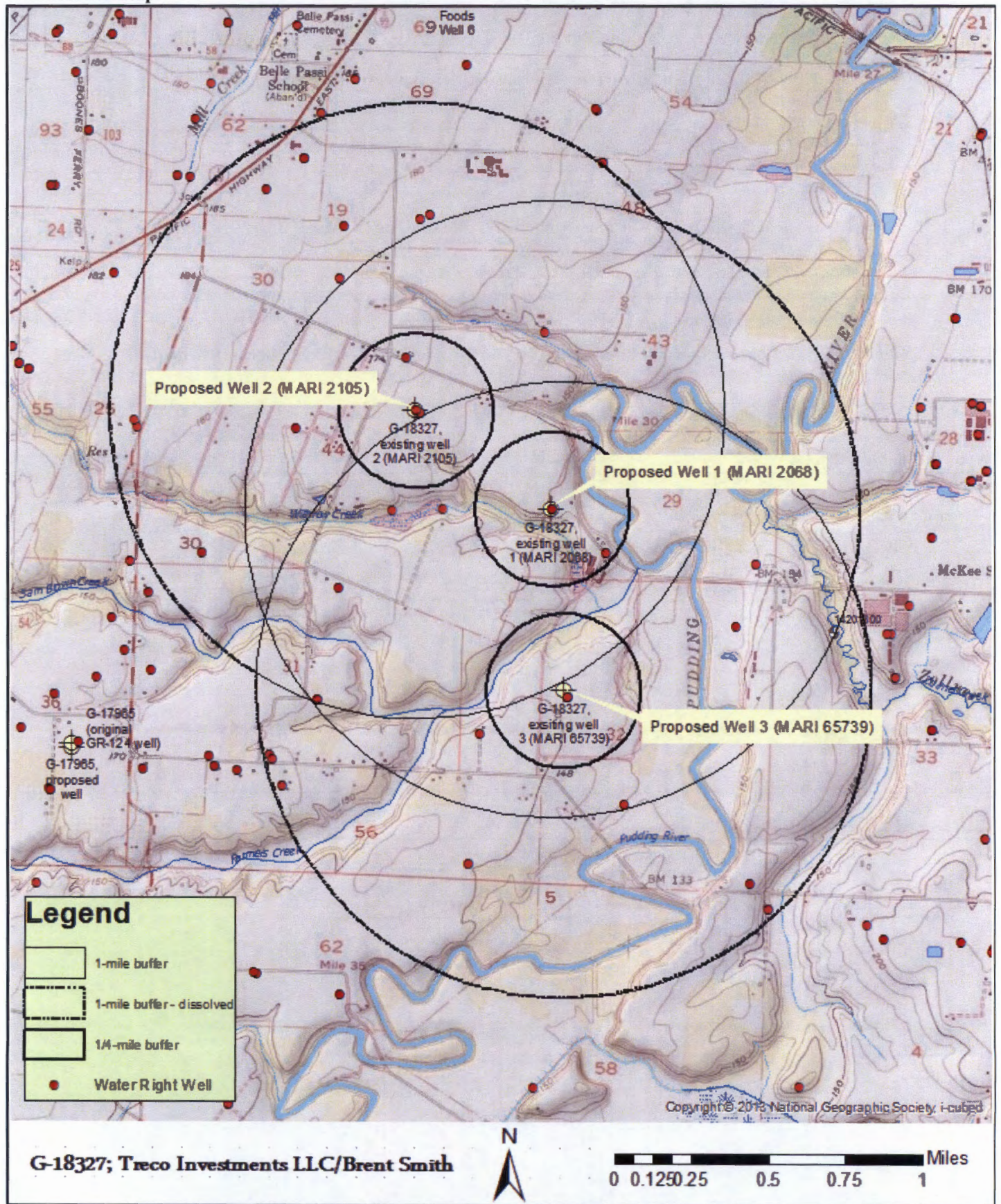
Watershed ID #: 151 Exceedance Level: 80
Time: 10:10 AM Date: 11/14/2016

Month	Natural Stream Flow	Consumptive Use and Storage	Expected Stream Flow	Reserved Stream Flow	Instream Requirements	Net Water Available
Monthly values are in cfs. Storage is the annual amount at 50% exceedance in ac-ft.						
JAN	1,040.00	123.00	917.00	0.00	36.00	881.00
FEB	1,180.00	113.00	1,070.00	0.00	36.00	1,030.00
MAR	1,010.00	78.30	932.00	0.00	36.00	896.00
APR	787.00	54.20	733.00	0.00	36.00	697.00
MAY	425.00	51.70	373.00	0.00	36.00	337.00
JUN	224.00	72.90	151.00	0.00	36.00	115.00
JUL	109.00	113.00	-4.01	0.00	36.00	-40.00
AUG	71.00	93.30	-22.30	0.00	36.00	-58.30
SEP	67.30	54.30	12.30	0.00	36.00	-28.00
OCT	91.60	14.00	77.60	0.00	36.00	41.60
NOV	363.00	48.00	315.00	0.00	36.00	279.00
DEC	957.00	117.00	840.00	0.00	36.00	804.00
ANN	706,000	56,400	650,000	0	26,100	626,000

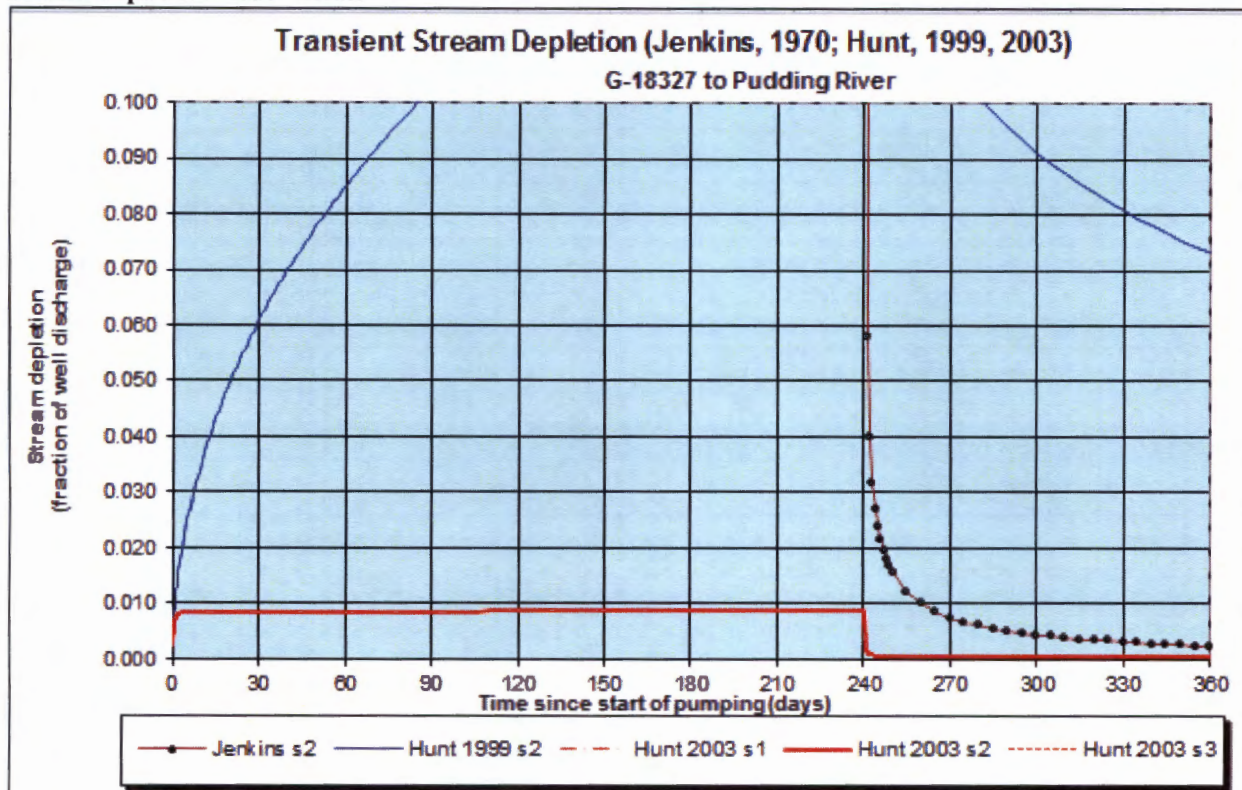
Water-Level Trends in Nearby Wells



Well Location Map

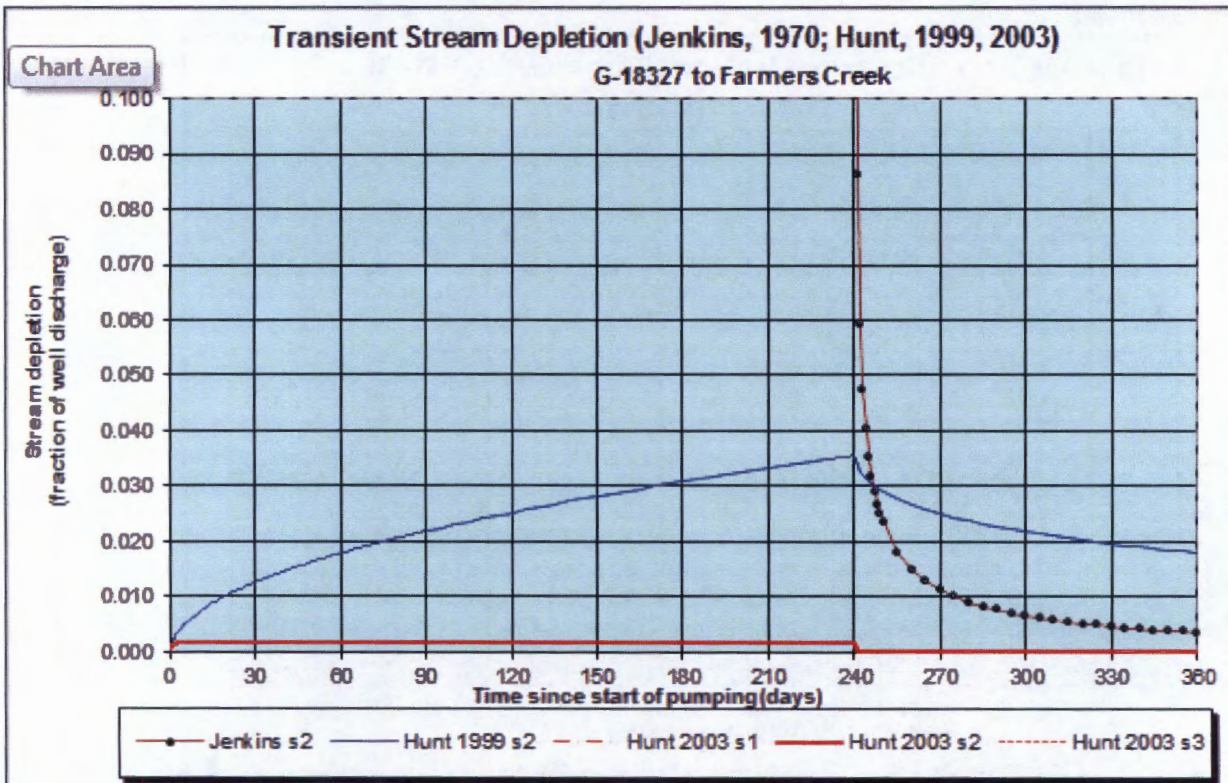


Stream Depletion Model Result



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 240 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	98.9%	99.2%	99.3%	99.4%	99.5%	99.5%	99.6%	99.6%	0.8%	0.4%	0.3%	0.2%
H SD 1999	6.1%	8.5%	10.3%	11.7%	13.0%	14.1%	15.1%	16.0%	10.7%	9.1%	8.1%	7.3%
H SD 2003	0.84%	0.84%	0.85%	0.86%	0.87%	0.88%	0.89%	0.90%	0.07%	0.07%	0.07%	0.07%
Qw, cfs	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729
H SD 99, cfs	0.044	0.062	0.075	0.085	0.095	0.103	0.110	0.116	0.078	0.066	0.059	0.053
H SD 03, cfs	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.000	0.000	0.000	0.000

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	327.00	327.00	327.00	gpm
Time pump on (pumping duration)	tpon	240	240	240	days
Perpendicular from well to stream	a	650	650	650	ft
Well depth	d	363	363	363	ft
Aquifer hydraulic conductivity	K	50	50	50	ft/day
Aquifer saturated thickness	b	70	70	70	ft
Aquifer transmissivity	T	3500	3500	3500	ft ² /day
Aquifer storativity or specific yield	S	0.0001	0.0001	0.0001	
Aquitard vertical hydraulic conductivity	Kva	0.01	0.01	0.01	ft/day
Aquitard saturated thickness	ba	80	80	80	ft
Aquitard thickness below stream	babs	40	40	40	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	50	50	50	ft
Streambed conductance (lambda)	sbc	0.012500	0.012500	0.012500	ft/day
Stream depletion factor	sdf	0.012071	0.012071	0.012071	days
Streambed factor	sbf	0.002321	0.002321	0.002321	
input #1 for Hunt's Q_4 function	t'	82.840237	82.840237	82.840237	
input #2 for Hunt's Q_4 function	K'	0.015089	0.015089	0.015089	
input #3 for Hunt's Q_4 function	epsilon'	0.000500	0.000500	0.000500	
input #4 for Hunt's Q_4 function	lamda'	0.002321	0.002321	0.002321	



Output for Stream Depletion, Scenerio 2 (s2):					Time pump on (pumping duration) = 240 days							
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	98.3%	98.8%	99.0%	99.2%	99.2%	99.3%	99.4%	99.4%	1.1%	0.7%	0.5%	0.4%
H SD 1999	1.3%	1.8%	2.2%	2.5%	2.8%	3.1%	3.3%	3.6%	2.5%	2.2%	2.0%	1.8%
H SD 2003	0.16%	0.16%	0.16%	0.16%	0.17%	0.17%	0.17%	0.17%	0.01%	0.01%	0.01%	0.01%
Qw, cfs	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729	0.729
H SD 99, cfs	0.009	0.013	0.016	0.018	0.021	0.022	0.024	0.026	0.018	0.016	0.014	0.013
H SD 03, cfs	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	327.00	327.00	327.00	gpm
Time pump on (pumping duration)	tpon	240	240	240	days
Perpendicular from well to stream	a	970	970	970	ft
Well depth	d	299	299	299	ft
Aquifer hydraulic conductivity	K	50	50	50	ft/day
Aquifer saturated thickness	b	70	70	70	ft
Aquifer transmissivity	T	3500	3500	3500	ft ² /day
Aquifer storativity or specific yield	S	0.0001	0.0001	0.0001	
Aquitard vertical hydraulic conductivity	Kva	0.01	0.01	0.01	ft/day
Aquitard saturated thickness	ba	80	80	80	ft
Aquitard thickness below stream	babs	40	40	40	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	10	10	10	ft
Streambed conductance (lambda)	sbc	0.002500	0.002500	0.002500	ft/day
Stream depletion factor	sdf	0.026883	0.026883	0.026883	days
Streambed factor	sbf	0.000693	0.000693	0.000693	
input #1 for Hunt's Q_4 function	t'	37.198427	37.198427	37.198427	
input #2 for Hunt's Q_4 function	K'	0.033604	0.033604	0.033604	
input #3 for Hunt's Q_4 function	epsilon'	0.000500	0.000500	0.000500	
input #4 for Hunt's Q_4 function	lamda'	0.000693	0.000693	0.000693	