Groundwater Application Review Summary Form

Application # G- 18803 (re-review)

GW Reviewer Travis Brown **Date Review Completed:** 1/23/2020

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).

WATER RESOURCES DEPARTMENT

MEMO January 23, 2020

TO: **Application** G- 18803 (re-review)

FROM: **GW:** Travis Brown
(Reviewer's Name)

SUBJECT: Scenic Waterway Interference Evaluation

☐ YES
The source of appropriation is within or above a Scenic Waterway
☒ NO

☐ YES
Use the Scenic Waterway condition (Condition 7J)
☒ NO

☐ Per ORS 390.835, the Groundwater Section is **able** to calculate ground water interference with surface water that contributes to a Scenic Waterway. The calculated interference is distributed below.

☐ Per ORS 390.835, the Groundwater Section is **unable** to calculate ground water 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 water flows necessary to maintain the free-flowing character of a scenic waterway.**

DISTRIBUTION OF INTERFERENCE

Calculate the percentage of consumptive use by month and fill in the table below. If interference cannot be calculated, per criteria in 390.835, do not fill in the table but check the "unable" option above, thus informing Water Rights that the Department is *unable to make a Preponderance of Evidence finding.*

Exercise of this permit is calculated to reduce monthly flows in _____ Scenic Waterway by the following amounts expressed as a proportion of the consumptive use by which surface water flow is reduced.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date January 23, 2020
FROM: Groundwater Section Travis Brown
Reviewer's Name
SUBJECT: Application G- 18803 Supersedes review of June 14, 2019 (changes in red)
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: **Kurt and Koreen Metzger** County: **Marion**

A1. Applicant(s) seek(s) 0.419[a] cfs from 2 well(s) in the Willamette Basin, Molalla-Pudding subbasin

A2. Proposed use Irrigation (48 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	Proposed	1	CRB	0.209[a]	7S/1W-19 SE-NE	150' S fr center of NE ¼ S 19
2	Proposed	2	CRB	0.209[a]	7S/1W-19 SE-NE	581' S, 420' E fr center of NE ¼ S 19

* 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	~300[b]				~400	0-300	0-300		300-400			
2	~302[b]				~400	0-300	0-300		300-400			

Use data from application for proposed wells.

A4. **Comments:** The proposed POA/POU is approximately 1.5 miles southeast of the unincorporated community of Pratum, Oregon. The applicable duty is 2.5 ft/ac; therefore, the maximum allowable volume would be 120 af/year.

[a] The applicant has amended their application so that "Total maximum rate requested" is 0.419 cfs (~188 gpm) and the well-specific rates are 0.209 cfs (~94 gpm) each.

[b] Well elevations estimated from LIDAR surface data at proposed POA locations (WSI, 2013).

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: The proposed POA would produce from a confined basalt aquifer; therefore, per OAR 690-502-0240, the relevant Willamette Basin rules (OAR 690-502-0140) do not apply.

A6. ☐ **Well(s) #** _____ , _____ , _____ , _____ , _____ , tap(s) an aquifer limited by an administrative restriction.
Name of administrative area: **N/A**
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) **7i (Willamette basalt condition), 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 **Columbia River Basalt** 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. **Special Conditions:**

1. Each basalt well shall be cased and continuously sealed from land surface to a depth of at least 50 feet to preclude hydraulic connection to nearby streams.

2. Each basalt well shall be open to a single aquifer of the Columbia River Basalt Group and shall meet the applicable well construction standards (OAR 690-200 and OAR 690-210). In addition, the open interval in each well shall be no greater than 100 feet. An open interval of greater than 100 feet may be allowed if substantial evidence of a single aquifer completion can be demonstrated to the satisfaction of the Department Hydrogeologists, using information from a video log, downhole flowmeter, water chemistry and temperature, or other downhole geophysical methods. These methods shall characterize the nature of the basalt rock and assess whether water is moving in the borehole. Any discernable movement of water within the well bore when the well is not being pumped shall be assumed as evidence of the presence of multiple aquifers in the open interval. If during well construction, it becomes apparent that the well can be constructed to eliminate interference with 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 request is made after casing and seal are placed, the requested modification will not be approved. If approved, the new well depth and construction specifications will be incorporated into any certificate issued for this permit.

3. A dedicated water-level measuring tube shall be installed in each well. The measuring tube shall meet the standards described in OAR 690-215-0060. When requested, access to the wells shall be provided to Department staff in order to make water-level measurements.

4. The applicant shall coordinate with the driller to ensure that drill cuttings are collected at 10 ft intervals and at changes in formation in each well. A split of each sampled interval shall be provided to the Department.

5. Copies of all geologic and hydrogeologic reports completed for the permittee during the development of the wells, including geophysical well logs and borehole video logs, shall be provided to the Department. Except for borehole video

logs, two paper copies, or a single electronic copy, shall be provided of each report. Digital tables of any data shall be provided upon request.

Groundwater availability remarks: Groundwater for the proposed use cannot be determined to be over-appropriated due to insufficient available data regarding rates of recharge and the current quantity of groundwater withdrawals from the aquifer system.

The proposed POA will produce water from one or more water-bearing zones within the Columbia River Basalt Group (CRBG), a series of lava flows with composite thickness of ~200 ft in this area (Conlon et al., 2005). CRBG thickness maps suggest that the area of the proposed POA was a paleotopographic high prior to emplacement of the CRBG (Conlon et al., 2005); as such, some of the lower units of the CRBG (Ortley and Umtanum members of the Grand Ronde flows) present elsewhere nearby may not be present at the proposed POA locations.

Each lava flow is characterized by a series of thick, dense, very low permeability interior zones separated by higher-permeability interflow zones comprised of weathered lava flow tops, (sometimes) sedimentary interbeds, and fractured flow bottoms. Unconfined groundwater occurs near the weathered tops of the basalts, but most water occurs in interflow zones at the contacts between lava flows, resulting in a series of stacked, thin aquifers that are confined by dense flow interiors and often have unique water level heads (Reidel et al., 2002).

Constructing a well that is open to multiple water-bearing zones with distinct water level heads can commingle multiple aquifers. When the pump is off, water can continue to flow through the well bore from an aquifer of higher pressure to an aquifer of lower pressure. Over time, this can depressurize the aquifers and exacerbate water level decline. The well construction conditions specified in B(3) help to protect the resource and other existing users.

The Waldo Hills area is deformed by a series of northwest- and northeast-trending fault zones that create numerous fault-bounded blocks (horsts and grabens) (Tolan, 1999). The faults juxtapose permeable interflow zones with dense flow interiors, possibly resulting in low flow boundaries at the fault traces which compartmentalize the CRBG aquifers. The degree of compartmentalization in the proposed aquifer is unknown, but could limit the aquifer extent (and therefore water availability) as well as exacerbate well-to-well interference amongst wells within the same fault block.

Water levels from nearby observation wells completed in the CRBG aquifer(s) suggest that other groundwater users are using the same aquifer which would be tapped by the proposed POA (see attached Hydrograph). The available water level data does not indicate widespread or consistent declines in the local basalt aquifer over the past decade. However, because pumping impacts will propagate outwards at rapid rates and likely reach the aquifer boundaries, conditions in the aquifer may change quickly.

Well statistics for basalt wells completed to similar depths in Sections 17 to 20 of T7S/R1W indicate reported yields ranging from 5 to 1000 gpm, with a median of 50 gpm. To achieve the requested use of 0.895 cfs (401.5 gpm), each of the applicant's proposed wells would need to yield greater than ~200 gpm (~0.446 cfs), which is ~400% of the median reported yield for nearby basalt wells but still within the range of reported yields (see Well Statistics, attached).

The nearest known CRBG groundwater right to the proposed POA is MARI 6334, an exempt domestic well which appears to be owned by the applicant. The next nearest known CRBG groundwater right is MARI 6335, an exempt domestic well ~420 ft south-southwest of proposed POA 2. MARI 6335 is reportedly ~433 ft deep and appears to be open to both the CRBG and the underlying marine sedimentary unit(s). As such, any interference with MARI 6335 from the proposed POA through the CRBG aquifer(s) may be mitigated somewhat by the influence of water-bearing zones (if present) in the deeper marine sedimentary units. However, under the standard condition for basalt aquifers in the Willamette Basin, Condition 7i, the requested use would need to be curtailed if hydraulic interference exceeded 15 ft in any neighboring well providing senior exempt uses or covered by prior rights.

To evaluate the potential interference at MARI 6335 due to the proposed use, a Theis (1935) drawdown analysis was conducted. Hydraulic parameters used for the analysis were derived from regional data and studies (Pumping Test Reports; Conlon et al., 2005; McFarland and Morgan, 1996; Woodward et al., 1998) or are within a typical range of values for the given parameter within the hydrogeologic regime (Domenico and Mifflin, 1965; Freeze and Cherry, 1979). Results of the analysis indicate that interference with MARI 6335 is unlikely to exceed 15 ft within the conservative scenario of more than 100 days of continuous pumping from both proposed POA simultaneously at 94 gpm each (total 188 gpm / ~0.419 cfs) (see attached Drawdown Analyses. **Note: Drawdowns from POA 1 and 2 are additive**).

For any permit is issued pursuant to this application, it is recommended that the conditions specified in B(1)(d)(i), B(2)(c), and B(3) Special Conditions be applied to protect existing users and monitor the resource.

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	**CRB**	☒	☐
2	**CRB**	☒	☐

Basis for aquifer confinement evaluation: The CRB aquifers are confined by dense flow interiors that restrict vertical movement of groundwater. Nearby CRBG well logs and observation well data indicate static water levels above the water-bearing zone. As such, the CRB aquifers are considered confined in this area.

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	**Unnamed reservoir**	**~195-200**	**~280**	**~650**	☐	☒	☐	☐	☒
1	2	**Unnamed tributary to Pudding River**	**~195-200**	**~170-226**	**~2,560**	☐	☒	☐	☐	☒
1	3	**Pudding River**	**~195-200**	**~165-198**	**~3,540**	☐	☒	☐	☐	☒
2	1	**Unnamed reservoir**	**~195-200**	**~280**	**~630**	☐	☒	☐	☐	☒
2	2	**Unnamed tributary to Pudding River**	**~195-200**	**~170-226**	**~2,130**	☐	☒	☐	☐	☒
2	3	**Pudding River**	**~195-200**	**~165-212**	**~4,070**	☐	☒	☐	☐	☒

Basis for aquifer hydraulic connection evaluation: The nearby surface water elevations are above the estimated elevation of the water-bearing zone (interflow zone) anticipated to be tapped by the proposed POA. Because the nearby surface water sources do not appear to have incised through the dense flow interior overlying the water-bearing zone, the aquifer tapped by the proposed POA should be effectively isolated from overlying local streams. So long as the proposed POA are constructed as specified in Section B and the proposed well construction, no effective hydraulic connection to local streams is anticipated.

Water Availability Basin the well(s) are located within: PUDDING R > MOLALLA R - AB HOWELL PRAIRIE

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?
		☐	☐			☐		☐		☐

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: No hydraulically connected surface water sources were identified within 1 mile of the proposed POA.

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: N/A

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:** No hydraulically connected surface water sources were identified within 1 mile of the proposed POA.

References Used:

Application Files: G-18803, G-17993

Pumping Test Reports: MARI 6153, 6333, 53068

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.

Domenico, P.A. and Mifflin, 1965, Water from low-permeability sediments and land subsidence: Water Resource Research, v. 1, no. 4, p. 563-576.

Freeze, R.A. and Cherry, J.A., 1979, *Groundwater*, Prentice Hall, Englewood Cliffs, New Jersey, 604 p.

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.

McFarland, W.D., and Morgan, D.S., 1996, Description of the Ground-Water Flow System in the Portland Basin, Oregon and Washington: U.S. Geological Survey Water Supply Paper 2470-A, 58 p.

Reidel, S.P., Johnson, V.G., and Spane, F.A., 2002, Natural gas storage in basalt aquifers of the Columbia Basin, Pacific Northwest USA—A guide to site characterization: Richland, Wash., Pacific Northwest National Laboratory, 277 p.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, American Geophysical Union Transactions, vol. 16, p. 519-524.

Tolan, Terry L. and Beeson, Marvin H., 1999, Geologic Map of the Stayton NE 7.5 Minute Quadrangles, Northwest Oregon: A Digital Database: USGS Open File Report 99-141.

United States Geological Survey, 2013, National Elevation Dataset (NED) [DEM geospatial data]. 1/9th arc-second, updated 2013.

United States Geological Survey, 2017, *Stayton NE quadrangle*, Oregon [map], 1:24,000, 7.5 minute topographic series, U.S. Department of the Interior, Reston, Virginia.

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.

WSI, 2013, OLC Clackamol, Portland, OR, September 30.

D. WELL CONSTRUCTION, OAR 690-200

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

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

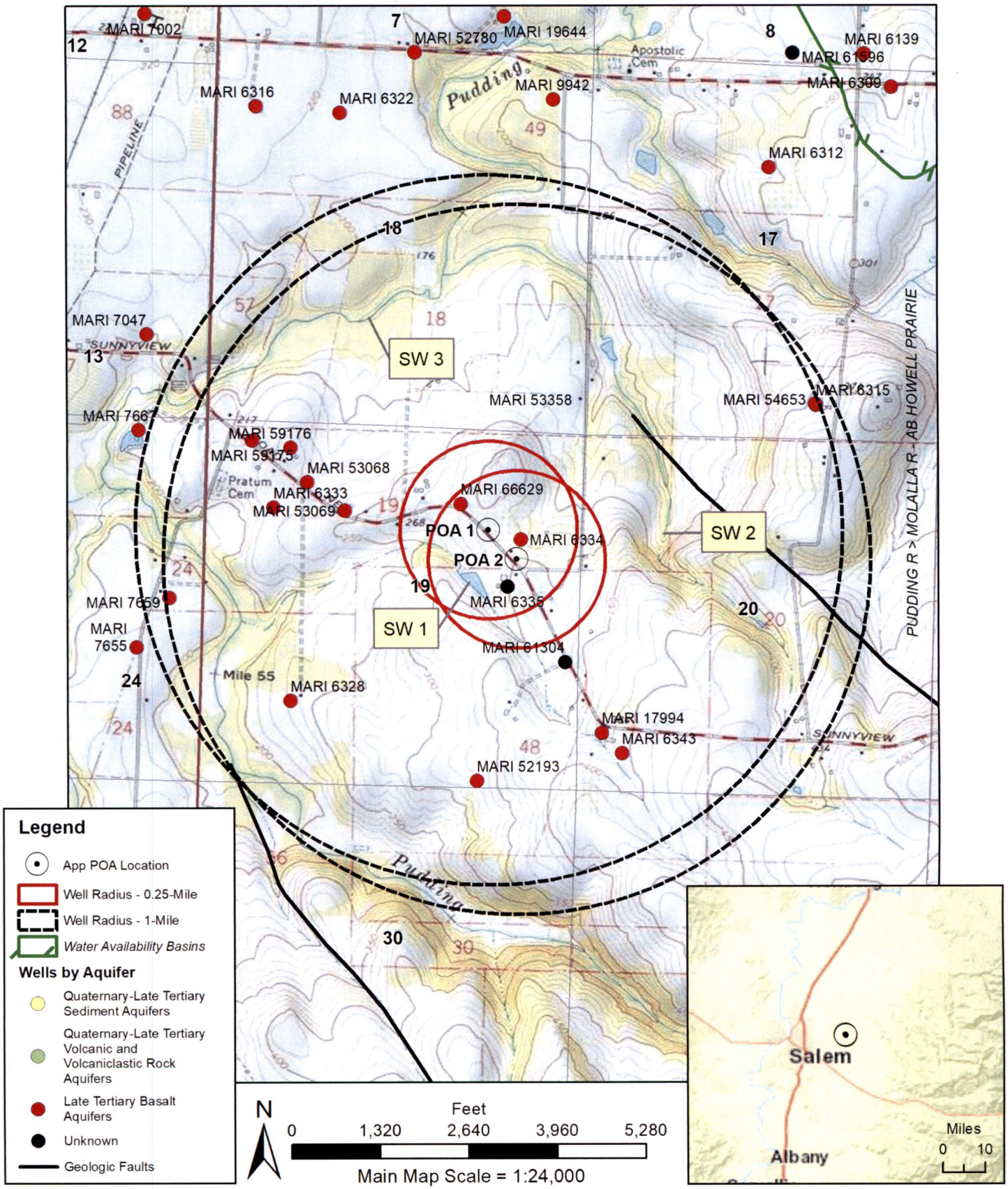
a. ☐ review of the well log;
b. ☐ field inspection by _____;
c. ☐ report of CWRE _____;
d. ☐ other: (specify) _____

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

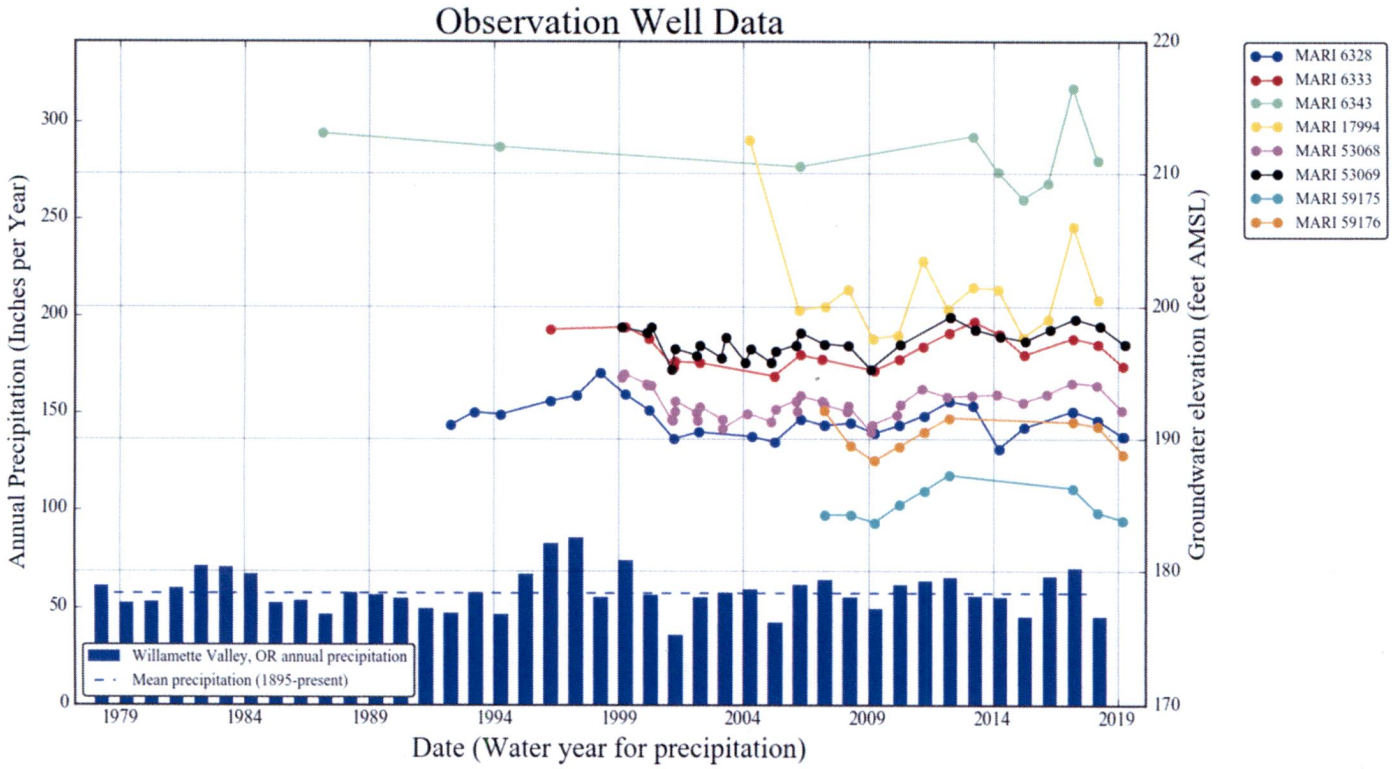
D4. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.**

Well Location Map

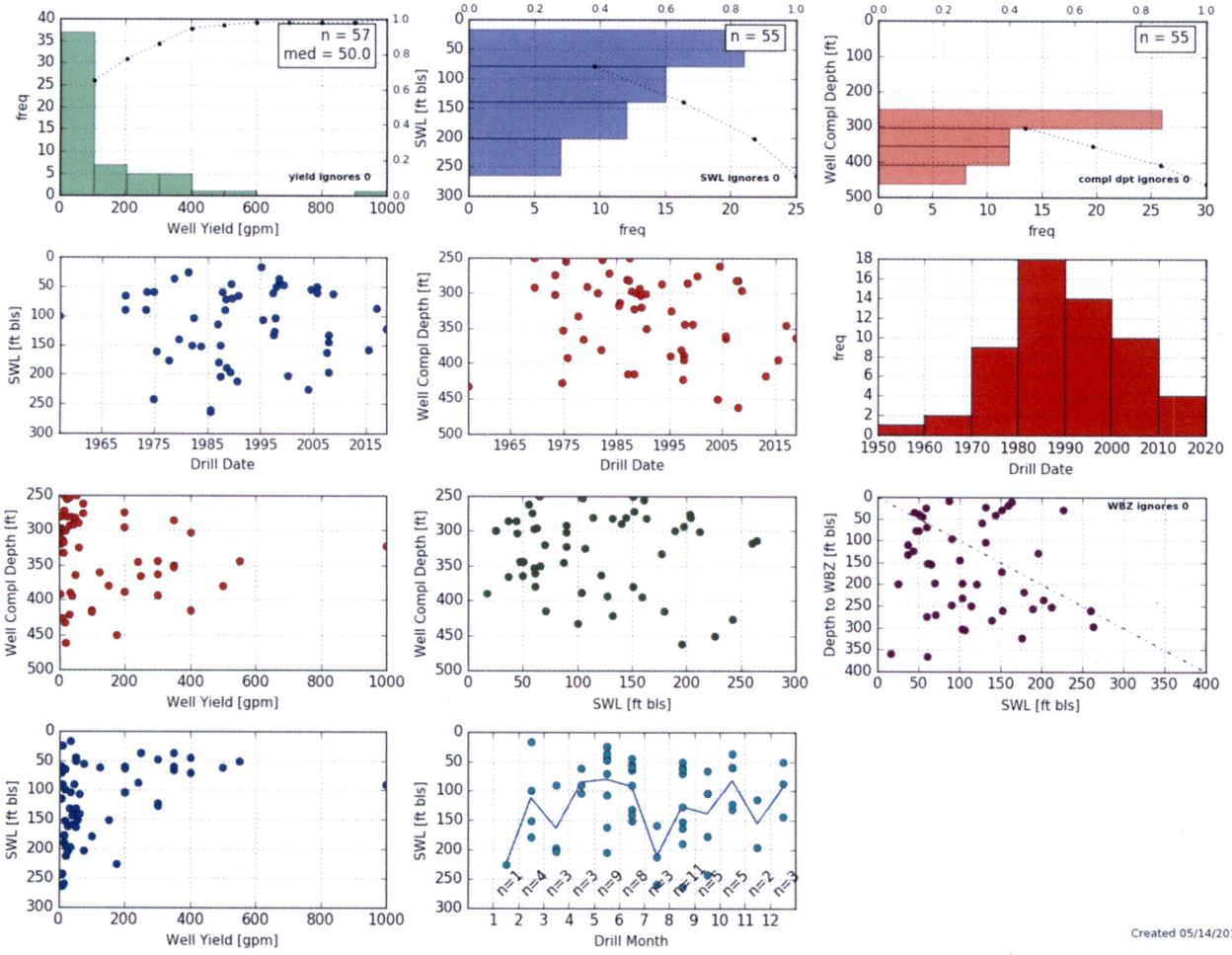
G-18803 Metzger



Hydrographs



Well Statistics



Drawdown Analysis – POA 1

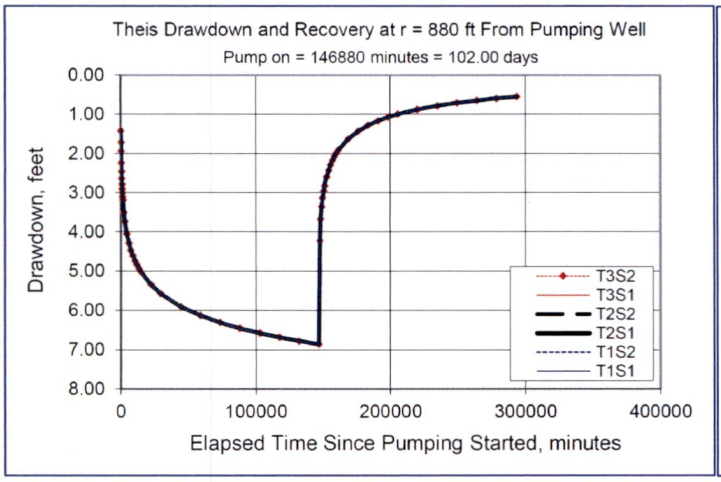
Theis Time-Drawdown Worksheet v.3.00

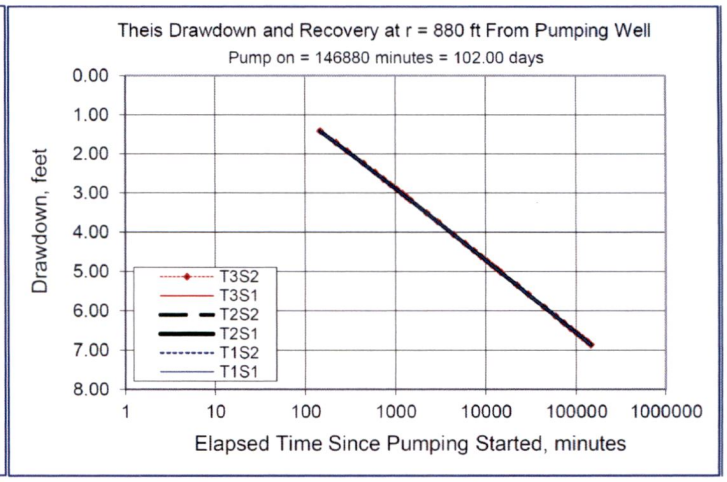
Calculates Theis nonequilibrium drawdown and recovery at any arbitrary radial distance, r, from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.

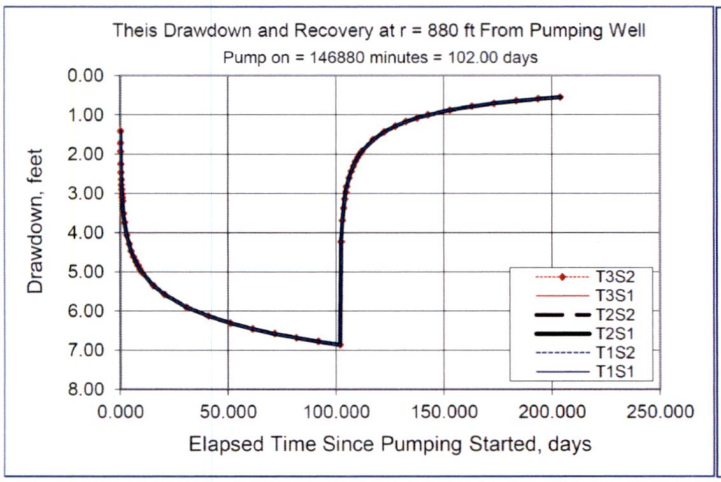
Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

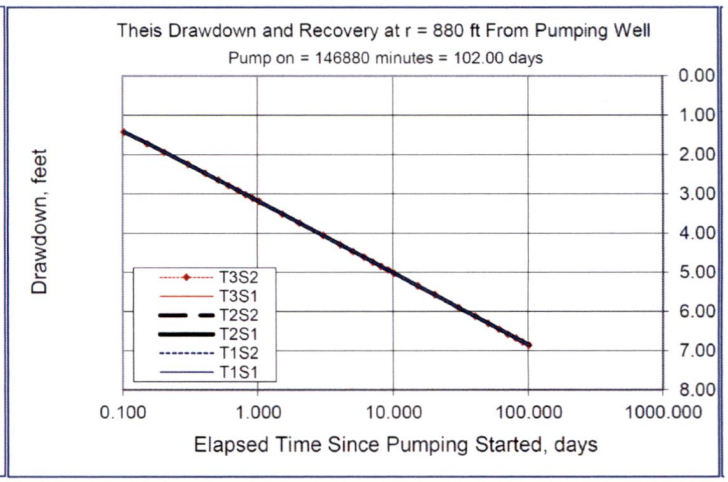
Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units	
Total pumping time	t		102		d	
Radial distance from pumped well:	r		880.00		ft	Q conversions
Pumping rate	Q		94.0		gpm	94.00 gpm
Hydraulic conductivity	K	36	36	36	ft/day	0.21 cfs
Aquifer thickness	b		50		ft	12.57 cfm
Storativity	S_1		0.00010			18,096.26 cfd
	S_2		0.00010			0.42 af/d
Transmissivity Conversions	T_f2pd	1,800	1,800	1,800	ft2/day	
	T_ft2pm	1.2500	1.2500	1.2500	ft2/min	
	T_gpdpft	13,464	13,464	13,464	gpd/ft	

Use the Recalculate button if recalculation is set to manual









Drawdown Analysis – POA 2

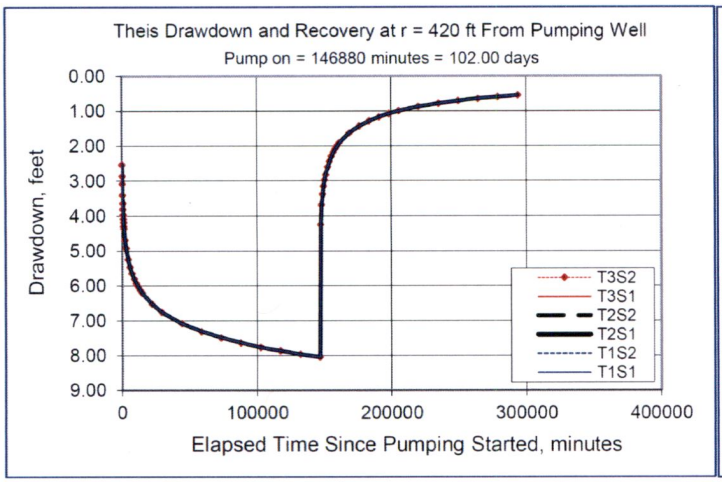
Theis Time-Drawdown Worksheet v.3.00

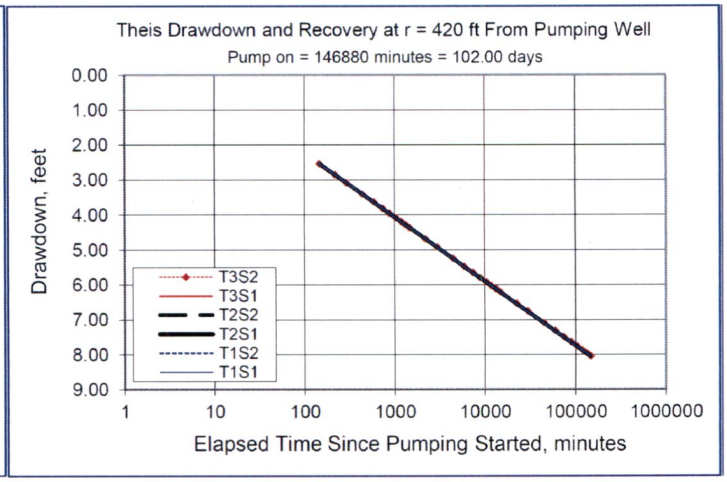
Calculates Theis nonequilibrium drawdown and recovery at any arbitrary radial distance, r, from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.

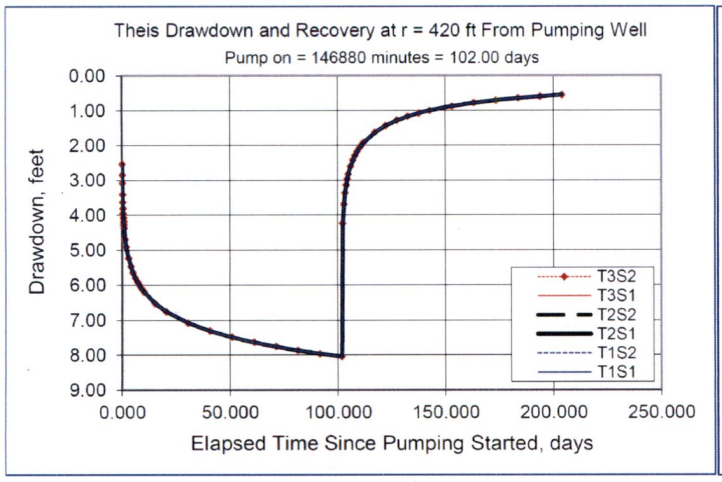
Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

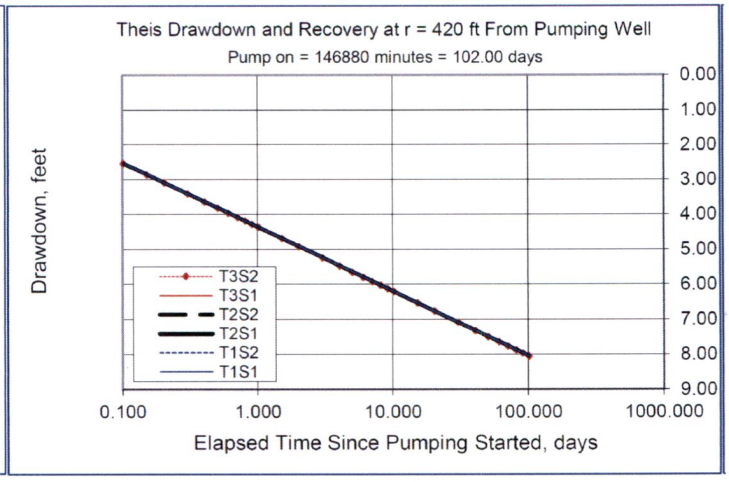
Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units	
Total pumping time	t		102		d	
Radial distance from pumped well:	r		420.00		ft	Q conversions
Pumping rate	Q		94.0		gpm	94.00 gpm
Hydraulic conductivity	K	36	36	36	ft/day	0.21 cfs
Aquifer thickness	b		50		ft	12.57 cfm
Storativity	S_1		0.00010			18,096.26 cfd
	S_2		0.00010			0.42 af/d
Transmissivity Conversions	T_f2pd	1,800	1,800	1,800	ft2/day	
	T_ft2pm	1.2500	1.2500	1.2500	ft2/min	
	T_gpdpft	13,464	13,464	13,464	gpd/ft	

Use the Recalculate button if recalculation is set to manual









Drawdown Analysis – Total Drawdown at MARI 6335 (POA 1 + POA 2)