

Groundwater Transfer Review Summary Form

Transfer/PA # T- 13667

GW Reviewer Gerald H. Grondin

Date Review Completed: 8 December 2021

Summary of Same Source Review:

☐ The proposed change in point of appropriation is not within the same aquifer as per OAR 690-380-2110(2).

Summary of Injury Review:

☐ The proposed transfer will result in another, existing water right not receiving previously available water to which it is legally entitled or result in significant interference with a surface water source as per 690-380-0100(3).

Summary of GW-SW Transfer Similarity Review:

☐ The proposed SW-GW transfer doesn't meet the definition of "similarly" as per OAR 690-380-2130.

☒ None of the Above

This is only a summary. Documentation is attached and should be read thoroughly to understand the basis for determinations.



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Ground Water Review Form:

- ☒ Water Right Transfer
☐ Permit Amendment
☐ GR Modification
☐ Other

Application: **T-13667**

Applicant Name: **Cottonwood Cattle Company, LLC**

Proposed Changes: ☒ POA ☐ APOA ☐ SW→GW ☐ RA
☐ USE ☒ POU ☐ OTHER

Reviewer(s): **Gerald H. Grondin**

Date of Review: **8 December 2021**

Date Reviewed by GW Mgr. and Returned to WRSD: **JTI 2/1/22**

The information provided in the application is insufficient to evaluate whether the proposed transfer may be approved because:

- ☐ The water well reports provided with the application do not correspond to the water rights affected by the transfer.
- ☐ The application does not include water well reports or a description of the well construction details sufficient to establish the ground water body developed or proposed to be developed.
- ☐ Other _____

1. Basic description of the changes proposed in this transfer: _____

This transfer application relates to water right certificate 62470 that authorizes primary irrigation of 159.3 POU acres with groundwater from well LAKE 2163/LAKE 51920 at a maximum rate of 1.99 cfs (893 gpm) and a maximum annual duty volume of 3 ac-ft per acre (477.9 ac-ft maximum total volume per year) all within T39S/R19E-sec 04. The transfer application proposes moving various POU segments (6.49 acres total) within T39S/R19E-sec 04 also and replacing the currently failing approved POA/POD well (LAKE 2163/LAKE 51920) with a proposed well to be drilled 213 feet southeast of the currently approved POA/POD well (based on application map metes and bounds, application text says 100 feet south).

2. Will the proposed POA develop the same aquifer (source) as the existing authorized POA?
☒ Yes ☐ No Comments: _____

Yes, the proposed POA/POD replacement well is proposed to be drilled within 250 feet of the currently approved POA/POD well, is proposed to be drilled to a comparable depth as the currently approved POA/POD well (700 feet total depth which is 50 feet deeper than the currently approved POA/POD well), and is proposed to be constructed similarly to the currently approved POA/POD well (seal depth, amount of casing, perforated interval).

3. a) Is there more than one source developed under the right (e.g., basalt and alluvium)?
☐ Yes ☒ No _____

No. The currently approved POA/POD well obtains groundwater from the predominantly basin-fill sedimentary unit that overlies the predominantly volcanic rock and sediment unit. The proposed replacement POA/POD well is anticipated to similarly obtain groundwater from the predominantly basin-fill sedimentary unit that overlies the predominantly volcanic rock and sediment unit. The basin-fill sedimentary unit and the underlying predominantly volcanic rock and sediment unit are hydraulically connected.

b) If yes, estimate the portion of the right supplied by each of the sources and describe any limitations that will need to be placed on the proposed change (rate, duty, etc.): _____

N.A.

4. a) Will this proposed change, at its maximum allowed rate of use, likely result in an increase in interference with **another ground water right**?
☐ Yes ☒ No Comments: _____

The proposed POA well change will move groundwater pumping about 200 feet closer to existing groundwater right POA wells. The proposed transfer should result in an increase in seasonal groundwater level drawdown (interference) calculated not to exceed 0.40 feet at the closest existing groundwater right POA well. The increased seasonal groundwater level drawdown (interference) at other existing groundwater right POA wells that are further away is expected to be less. The long-term impact on the groundwater system should be the same.

b) If yes, would this proposed change, at its maximum allowed rate of use, likely result in another groundwater right not receiving the water to which it is legally entitled?

☐ Yes ☒ No If yes, explain: _____

The calculated increased seasonal groundwater level drawdown (interference) at other existing groundwater right POA wells will be less than noted in 4a above (0.40 feet). All those wells should be able to accommodate that increase.

5. a) Will this proposed change, at its maximum allowed rate of use, likely result in an increase in interference with **another surface water source**?

☐ Yes ☒ No Comments: _____

No.

The proposed POA/POD well change will move the groundwater pumping about 188 feet further away from Cottonwood Creek and Muddy Creek. Consequently, the groundwater pumping seasonal and long-term (annual) interference with those creeks should be the same or less.

The proposed POA/POD well change will move the groundwater pumping about 210 feet closer to Thomas Creek. The calculated increased drawdown at that creek is less than 0.12 feet maximum and the calculated increased interference is 0.006 cfs (2.7 gpm).

- b) If yes, at its maximum allowed rate of use, what is the expected change in degree of interference with any **surface water sources** resulting from the proposed change?

Stream: Cottonwood Creek ☒ Minimal ☐ Significant

Stream: Muddy Creek ☒ Minimal ☐ Significant

Stream: Thomas Creek ☒ Minimal ☐ Significant

Provide context for minimal/significant impact: _____

See comment in part 5a above.

6. For SW-GW transfers, will the proposed change in point of diversion affect the surface water source similarly (as per OAR 690-380-2130) to the authorized point of diversion specified in the water use subject to transfer?

☐ Yes ☒ No Comments: _____

Not Applicable. No SW-GW transfer.

7. What conditions or other changes in the application are necessary to address any potential issues identified above: _____

The following are technical groundwater review recommendations. It is recognized that one or more technically recommended conditions may or may not be allowed under the transfer process rules and statutes. This technical groundwater review relies on other appropriate and authorized Department staff to make that determination.

“Large” flow meter condition for any proposed “To” POA and/or APOA well. Require the flow meter for any POA and/or APOA well to be properly installed and maintained. Each meter shall be either within 50 feet of the well head with a clearly visible monument adjacent to the meter or a surveyed location shall be provided and a clearly visible monument adjacent to the meter shall be installed for each meter more than 50 feet from the well head.

Condition 7P (well tag condition) for all the “To” and “From” POA wells.

Condition 7T (modified) for all “To” POA wells: “Prior to use, all POA wells shall be configured to allow a strictly clean water (no oil) static water level measurements with an electric-tape. That can include measurement access via an unobstructed vertical discharge pipe that allows the groundwater level to fluctuate freely within the discharge pipe (no valves, etc.). Otherwise, a dedicated measuring tube must be installed prior to use. The tube must be unobstructed, have a diameter of ¾ inch (0.75 inch) or greater, and pursuant to figure 200-5 in OAR 690-200.”

Special condition: The replacement POA/POD well shall obtain groundwater from the same predominantly basin-fill sedimentary unit that overlies the predominantly volcanic rock and sediment unit as the existing POA/POD well. If the replacement POA/POD well penetrates through the predominantly basin-fill sedimentary unit into the predominantly volcanic rock and sediment unit below, the predominantly volcanic rock and sediment unit section shall be properly abandoned according to well construction standard in consultation with the OWRD well inspector.

8. Any additional comments: _____

No additional comments.

References:

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

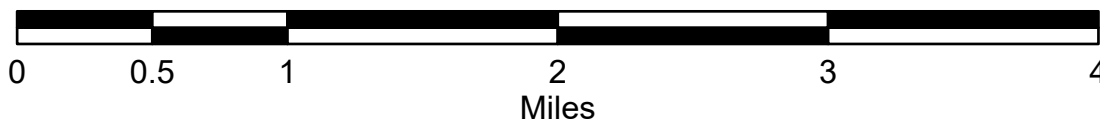
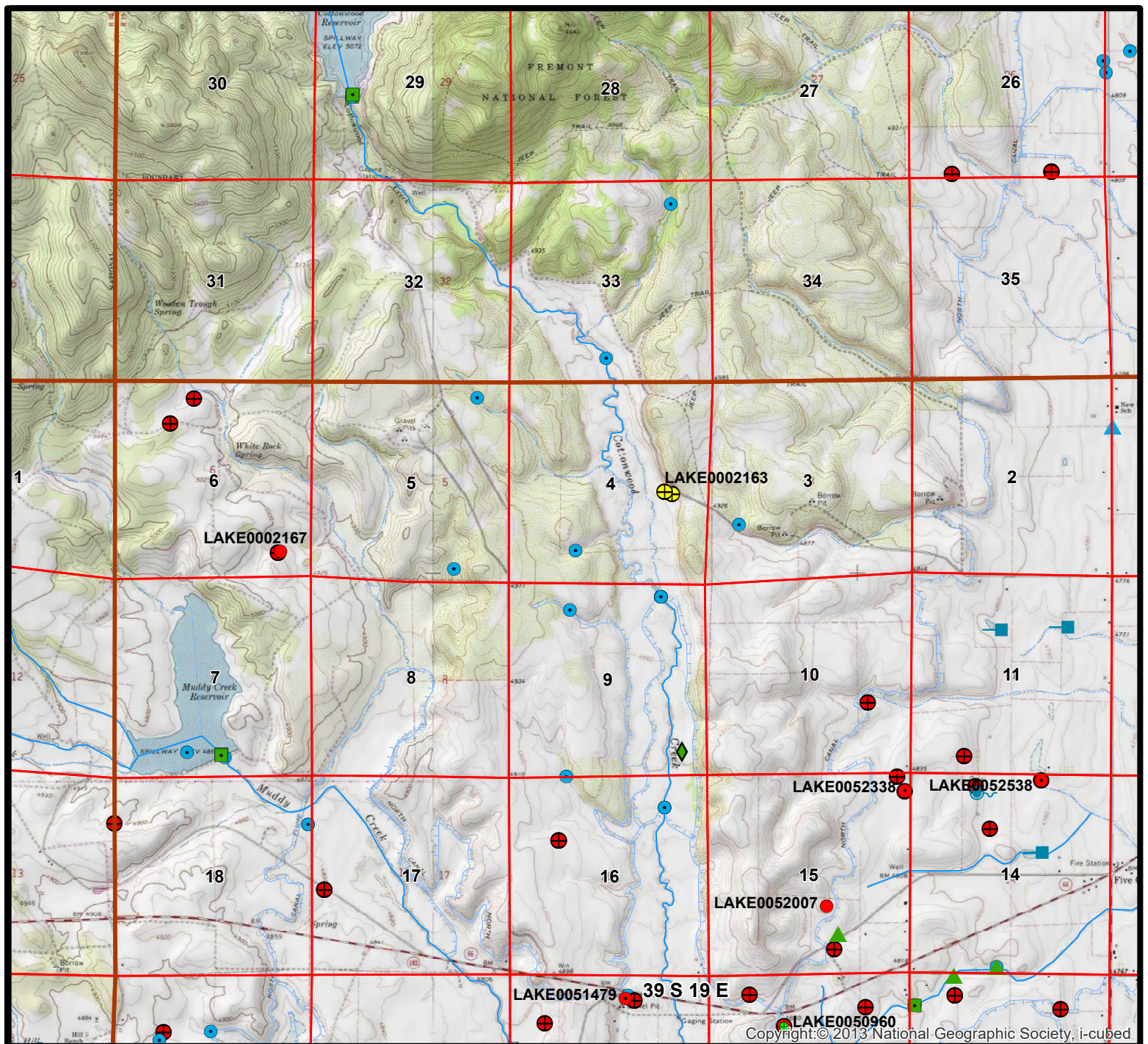
Morgan, D.S., 1988. Geohydrology and numerical model analysis of ground-water flow in the Goose Lake Basin, Oregon and California. USGS Water Resources Investigations Report 87-4058.

OWRD Well Log Database and OWRD Groundwater Information System Database

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, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

Groundwater Transfer Application T-13667

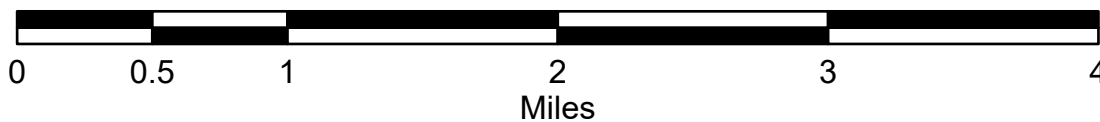
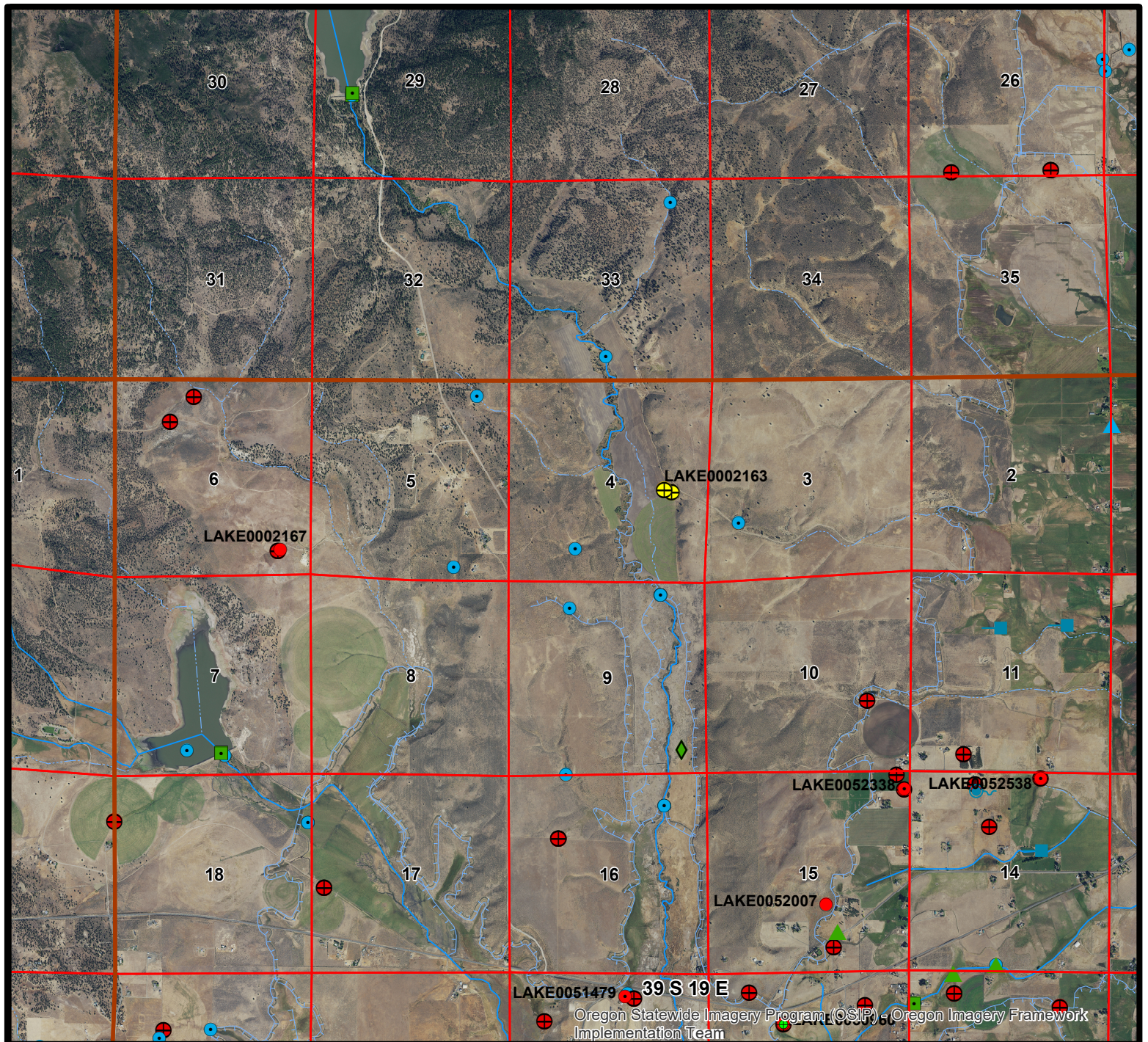
Cottonwood Cattle Company LLC



Yellow = Authorized & Proposed Wells
Red = Groundwater PODs, Obs & Other Wells
Blue & Green = Surface Water PODs



Groundwater Transfer Application T-13667 Cottonwood Cattle Company LLC



Yellow = Authorized & Proposed Wells
Red = Groundwater PODs, Obs & Other Wells
Blue & Green = Surface Water PODs



SP*45656-119

WELL LABEL # L 86242

START CARD #	1001392
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Form Version: 0.88

Drawdown Calculations Using Theis Equation	
Theis Equation: $s = [Q/(4 \cdot T \cdot \pi)] [W(u)]$ $u = (r^2 \cdot S)/(4 \cdot T \cdot t)$ $W(u) = (-\ln u) - (0.5772157) + (u/1 \cdot 1!) - (u^2/2 \cdot 2!) + (u^3/3 \cdot 3!) - (u^4/4 \cdot 4!) + \dots$	
s = drawdown (L)	r = radial distance (L)
T = transmissivity (L ² /T)	t = time (T)
S = storage coefficient (dimensionless)	u = dimensionless
π = 3.141592654	$W(u)$ = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft2/day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft3/sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Drawdown Change s (feet)	Comments
								Note : W(u) calculation valid when u < 7.1				
Note: yellow grid areas are where values are calculated								7.0000	1.1545E-04			W(u) calculation test
"From" POA well (Lake 2163/LAKE 51920) to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	30.00	7,800.00	3.14	0.2855	0.9426	7.2629		Continuous Pumping at Full Rate
			893.17	1.99						7.26		
Proposed "To" POA well to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	30.00	7,600.00	3.14	0.2711	0.9819	7.5660		Continuous Pumping at Full Rate
			893.17	1.99						7.57	0.3031	
"From" POA well (Lake 2163/LAKE 51920) to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	30.00	7,800.00	3.14	0.2855	0.9426	3.5893		Continuous Pro-Rated Pumping
			441.40	0.98						3.59		
Proposed "To" POA well to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	30.00	7,600.00	3.14	0.2711	0.9819	3.7391		Continuous Pro-Rated Pumping
			441.40	0.98						3.74	0.1498	

Drawdown Calculations Using Theis Equation

Theis Equation: $s = [Q/(4 \cdot T \cdot \pi)] [W(u)]$

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

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

s = drawdown (L)

T = transmissivity (L²/T)

S = storage coefficient (dimensionless)

pi = 3.141592654

r = radial distance (L)

t = time (T)

u = dimensionless

W(u) = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft ² /day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft ³ /sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Drawdown Change s (feet)	Comments
									Note : W(u) calculation valid when u < 7.1			
								7.0000	1.1545E-04			W(u) calculation test
Note: yellow grid areas are where values are calculated												
"From" POA well (Lake 2163/LAKE 51920) to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	245.00	7,800.00	3.14	0.0350	2.8109	21.6591		Continuous Pumping at Full Rate
			893.17	1.99						21.66		
Proposed "To" POA well to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	245.00	7,600.00	3.14	0.0332	2.8611	22.0459		Continuous Pumping at Full Rate
			893.17	1.99						22.05	0.3869	
"From" POA well (Lake 2163/LAKE 51920) to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	245.00	7,800.00	3.14	0.0350	2.8109	10.7038		Continuous Pro-Rated Pumping
			441.40	0.98						10.70		
Proposed "To" POA well to Closest Water Right Well (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	245.00	7,600.00	3.14	0.0332	2.8611	10.8950		Continuous Pro-Rated Pumping
			441.40	0.98						10.89	0.1912	

Drawdown Calculations Using Theis Equation	
Theis Equation: $s = [Q/(4 \cdot T \cdot \pi)] [W(u)]$ $u = (r^2 \cdot S)/(4 \cdot T \cdot t)$ $W(u) = (-\ln u) - (0.5772157) + (u/1 \cdot 1!) - (u^2/2 \cdot 2!) + (u^3/3 \cdot 3!) - (u^4/4 \cdot 4!) + \dots$	
s = drawdown (L)	r = radial distance (L)
T = transmissivity (L ² /T)	t = time (T)
S = storage coefficient (dimensionless)	u = dimensionless
π = 3.141592654	$W(u)$ = well function

Theis Equation: $s = [Q/(4 \cdot T \cdot \pi)] [W(u)]$

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

r = radial distance (L)

t = time (T)

u = dimensionless

$W(u)$ = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft2/day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft3/sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Drawdown Change s (feet)	Comments
								Note : W(u) calculation valid when u < 7.1				
Note: yellow grid areas are where values are calculated								7.0000	1.1545E-04			W(u) calculation test
"From" POA well to Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	30.00	21,430.00	3.14	2.1552	0.0395	0.3045		Continuous Pumping at Full Rate
			893.17	1.99						0.30		
Proposed "To" POA well Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	30.00	21,220.00	3.14	2.1132	0.0419	0.3225		Continuous Pumping at Full Rate
			893.17	1.99						0.32	0.0180	
"From" POA well to Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	30.00	21,430.00	3.14	2.1552	0.0395	0.1505		Continuous Pro-Rated Pumping
			441.40	0.98						0.15		
Proposed "To" POA well Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	30.00	21,220.00	3.14	2.1132	0.0419	0.1594		Continuous Pro-Rated Pumping
			441.40	0.98						0.16	0.0089	

Drawdown Calculations Using Theis Equation

Theis Equation: $s = [Q/(4 \cdot T \cdot \pi)] [W(u)]$

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

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

s = drawdown (L)

T = transmissivity (L²/T)

S = storage coefficient (dimensionless)

pi = 3.141592654

r = radial distance (L)

t = time (T)

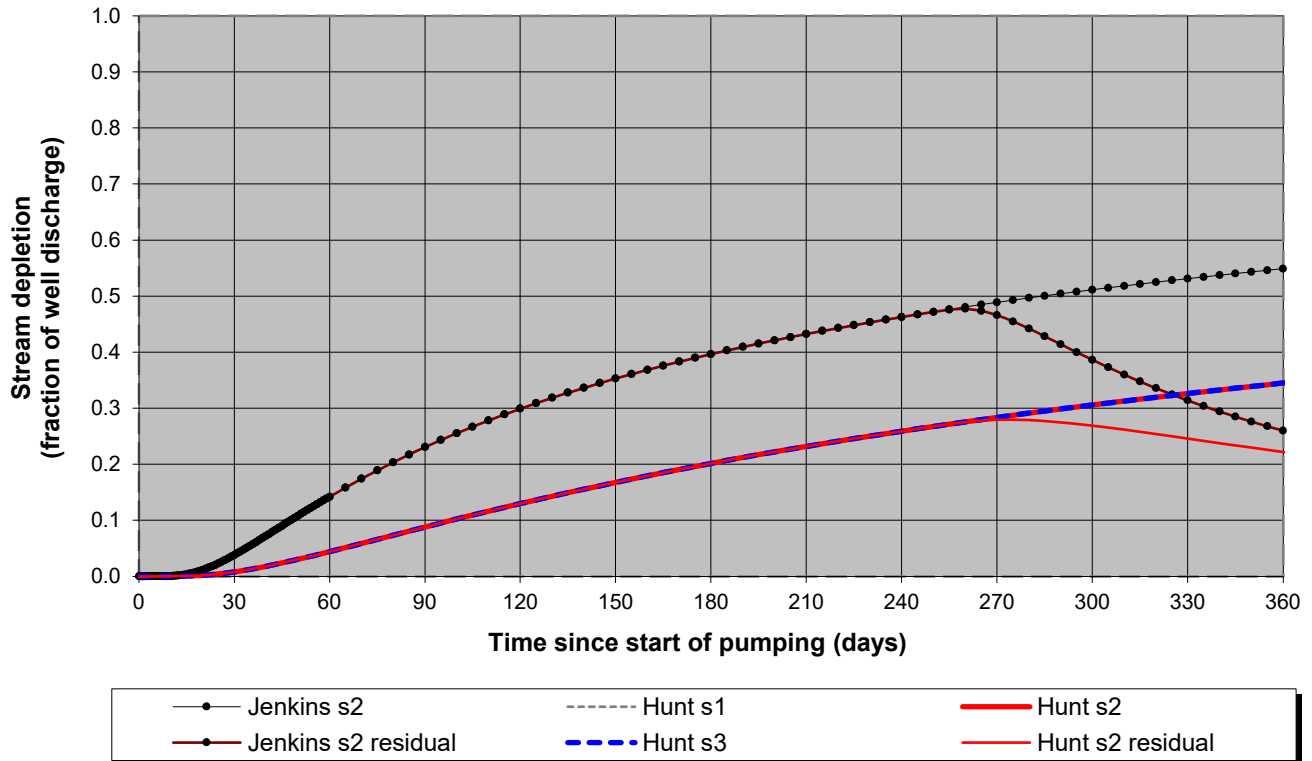
u = dimensionless

W(u) = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft ² /day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft ³ /sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Drawdown Change s (feet)	Comments
									Note : W(u) calculation valid when u < 7.1			
								7.0000	1.1545E-04			W(u) calculation test
"From" POA well to Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	245.00	21,430.00	3.14	0.2639	1.0024	7.7238		Continuous Pumping at Full Rate
			893.17	1.99						7.72		
Proposed "To" POA well Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	893.17	1.99	245.00	21,220.00	3.14	0.2588	1.0176	7.8407		Continuous Pumping at Full Rate
			893.17	1.99						7.84	0.1169	
"From" POA well to Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	245.00	21,430.00	3.14	0.2639	1.0024	3.8171		Continuous Pro-Rated Pumping
			441.40	0.98						3.82		
Proposed "To" POA well Thomas Creek (Transmissivity from LAKE 2163 specific capacity: Used S = 0.001)												
13,283.06	1,775.69	0.00100	441.40	0.98	245.00	21,220.00	3.14	0.2588	1.0176	3.8748		Continuous Pro-Rated Pumping
			441.40	0.98						3.87	0.0578	

Transient Stream Depletion (Jenkins, 1970; Hunt, 1999)

LAKE 2163/LAKE 51920 to Thomas Creek



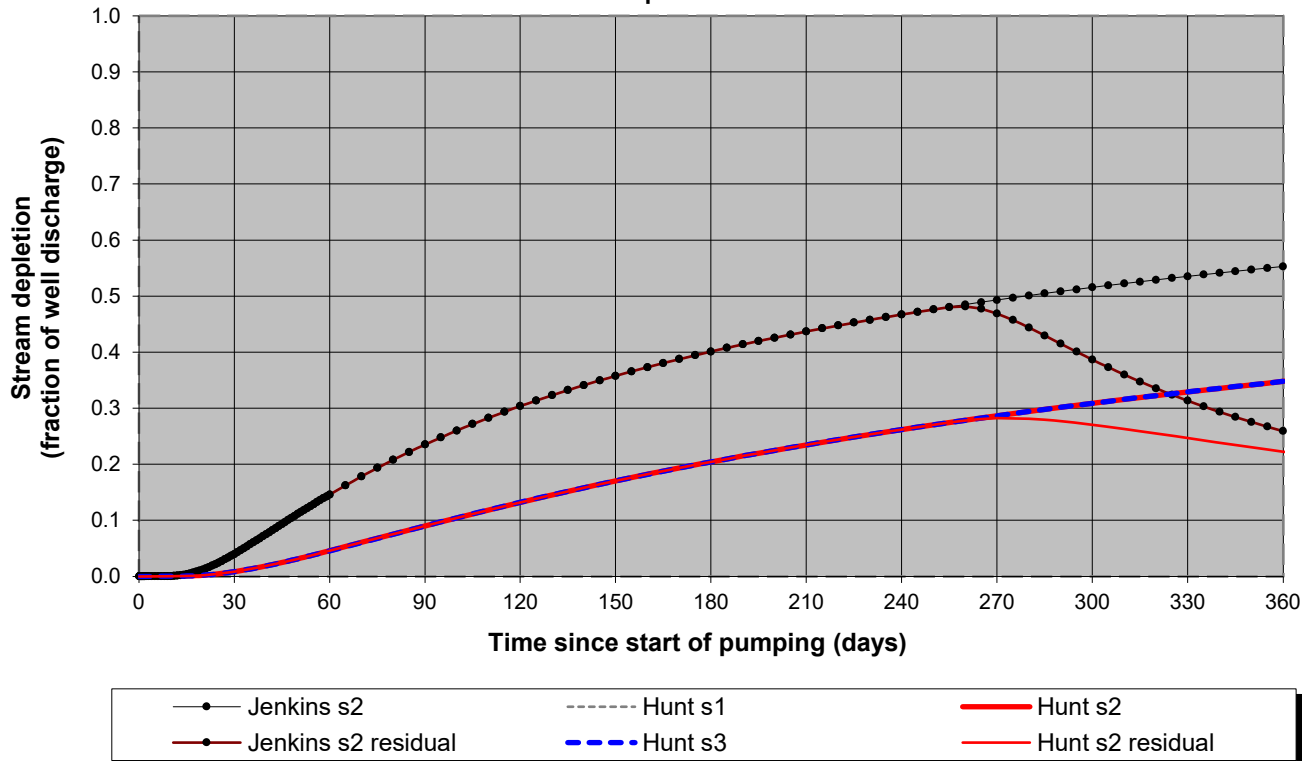
Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 245 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.0077	0.0440	0.0878	0.1296	0.1674	0.2013	0.2316	0.2589	0.2793	0.2688	0.2456	0.2219
Qw, cfs	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990
H SD s2, cfs	0.015	0.088	0.175	0.258	0.333	0.401	0.461	0.515	0.556	0.535	0.489	0.442

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	1.99	1.99	1.99	cfs
Distance to stream	a	21430	21430	21430	ft
Aquifer hydraulic conductivity	K	3.55	3.55	3.55	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	1775	1775	1775	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	20	20	20	ft
Streambed hydraulic conductivity	Ks	0.0355	0.0355	0.0355	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	0.236666667	0.236666667	0.236666667	ft/day
Stream depletion factor (Jenkins)	sdf	258.7295211	258.7295211	258.7295211	days
Streambed factor (Hunt)	sbf	2.857333333	2.857333333	2.857333333	

Transient Stream Depletion (Jenkins, 1970; Hunt, 1999)

Proposed POA/POD to Thomas Creek



Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 245 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.0081	0.0454	0.0898	0.1320	0.1701	0.2041	0.2345	0.2617	0.2819	0.2705	0.2466	0.2225
Qw, cfs	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990
H SD s2, cfs	0.016	0.090	0.179	0.263	0.338	0.406	0.467	0.521	0.561	0.538	0.491	0.443

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	1.99	1.99	1.99	cfs
Distance to stream	a	21220	21220	21220	ft
Aquifer hydraulic conductivity	K	3.55	3.55	3.55	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	1775	1775	1775	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	20	20	20	ft
Streambed hydraulic conductivity	Ks	0.0355	0.0355	0.0355	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	0.236666667	0.236666667	0.236666667	ft/day
Stream depletion factor (Jenkins)	sdf	253.6836056	253.6836056	253.6836056	days
Streambed factor (Hunt)	sbf	2.829333333	2.829333333	2.829333333	

Transmissivity from Specific Capacity using the Theis Equation

Adapted from Vorhis (1979)

Theis Equation: $T = [Q/(4 \cdot s \cdot \pi)] [W(u)]$

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

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

T = transmissivity (L²/T)

s = drawdown (L)

S = storage coefficient (dimensionless)

pi = 3.141592654

r = radial distance (L)

t = time (T)

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 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

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.

Data Entry

Enter Data Below (yellow boxes only)

Well Log ID or Comment for Records

LAKE 2163

Pumping Rate (gpm) = Q =

1,250.00

(gpm)

Drawdown (feet) = s =

167.00

(feet)

Time (hours) = t =

8.0000

(hours)

Storage Coefficient = S =

0.001000

(dimensionless)

Well Diameter (inches) = d =

12.0000

(inches)

Press F9 to Calculate

Calculated Results

Calculated Results

Transmissivity (ft²/day) = T =

1,775.69

(ft²/day)

Transmissivity (gpd/ft) = T =

13,283.06

(gpd/ft)

Transmissivity Difference = (last 2 iterations)

0.0000E+00

okay to use T if diff < 0.0001

(ft²/day)

u = (last iteration)

1.0559E-07

okay to use T if u < 7.1

Drawdown s (feet)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft ³ /sec)	Time t (days)	Distance r = d/2 (feet)	u	W(u)	Transmissivity T (ft ² /day)	Transmissivity difference from previous	Comments	Theis Equation Iteration	
Note: yellow grid areas are where values are calculated						Note : W(u) calculation valid when u < 7.1						
						7.0000	1.1545E-04	W(u) calculation test				
167.00	0.00100	1,250.00	2.79	0.33	0.50	1,440.87						T = Q/s
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.3013E-07	15.2775	1,751.73	3.1086E+02	T = Theis Equation	1.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0704E-07	15.4729	1,774.13	2.2400E+01	T = Theis Equation	2.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0569E-07	15.4856	1,775.59	1.4569E+00	T = Theis Equation	3.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0560E-07	15.4864	1,775.68	9.4120E-02	T = Theis Equation	4.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	6.0777E-03	T = Theis Equation	5.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	3.9246E-04	T = Theis Equation	6.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	2.5342E-05	T = Theis Equation	7.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	1.6364E-06	T = Theis Equation	8.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	1.0567E-07	T = Theis Equation	9.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	6.8233E-09	T = Theis Equation	10.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	4.4088E-10	T = Theis Equation	11.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	2.8422E-11	T = Theis Equation	12.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	13.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	14.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	15.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	16.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	17.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	18.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	19.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	20.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	21.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	22.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	23.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	24.00	
167.00	0.00100	1,250.00	2.79	0.33	0.50	1.0559E-07	15.4865	1,775.69	0.0000E+00	T = Theis Equation	25.00	