Appendix C

Hydrogeologic Field Characterization at Twin Pines Mine

Twin Pines Minerals, LLC

HYDROGEOLOGIC FIELD CHARACTERIZATION AT TWIN PINES MINE

Prepared For:

TWIN PINES MINERALS, LLC
PROPOSED HEAVY MINERALS MINE
ST. GEORGE, CHARLTON COUNTY, GEORGIA

Prepared By:

Robert M. Holt
Professor of Geology and Geological Engineering
The University of Mississippi
Department of Geology and Geological Engineering

J. Mark Tanner, PG
James R. Smith, P.G.
Austin C. Patton,
Zachary B. Lepchitz

TTL, Inc.
3516 Greensboro Avenue
Tuscaloosa, Alabama 35401
Project No. 000180200804.00, Phase 0400

October 31, 2019

TTL

JAMES MARK TANNER
No. 886
GEORGIA REGISTERED PROFESSIONAL GEOLOGIST
J Mark Tanner

JAMES R. SMITH
No. PG001873
10-31-19
GEORGIA REGISTERED PROFESSIONAL GEOLOGIST
James R. Smith

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INTRODUCTION

On July 3, 2019, Twin Pines Minerals (TPM) submitted an individual permit application to the U.S. Army Corps of Engineers for impacts to waters of the United States to develop a heavy mineral sand mine along Trail Ridge in Charlton County, Georgia (Figure 1). The proposed mine is located 3.2 miles west of St. George, Georgia, along Georgia State Highway Route 94. Trail Ridge is a 0.6 to 1.2 mile wide and 99 mile long topographic ridge that separates the Okefenokee Basin and Swamp from the coastal plain of Georgia (Force and Rich, 1979). It represents the crest of a former beach complex and was formed as inland sand dunes near the proposed Twin Pines Mine (e.g., Pirkle et al. 1993). The ridge is underlain by a shallow aquifer, locally known as the surficial aquifer, which forms a hydrologic divide between the Okefenokee swamplands to the west and the Saint Mary’s River to the east. At the proposed mine site, the water table is very shallow with water depths of only a few feet. The surficial aquifer is perched on the clays of the upper Hawthorn Group, which is considered to be the upper confining unit to the Floridian Aquifer in the region (e.g., Williams and Kuniansky, 2016).

The proposed permit area is approximately 2,414-acres, located southeast of the Okefenokee National Wildlife Refuge (ONWR) boundary; however, TPM will only mine an approximate 1,268-acre area located about 2.7 miles from the ONWR boundary (Figure 2). The portion of the proposed permit area extending from the western mining boundary to the edge of the permit boundary will be avoided and will provide a buffer to the ONWR.

The project study area consists of approximately 12,000-acres of land located near St. George, Charlton County, Georgia. This area is comprised of five (5) contiguous tracts identified as Loncala, Dallas Police & Fire, Keystone, TIAA, and Adirondack. Reference to “project study area” in this report refers to activities conducted within the proposed mining area and adjacent tracts.

This report is being submitted to document field activities performed to characterize the hydraulic properties of the surficial aquifer beneath the project study area. As part of these field activities, TTL conducted two 24-hour pumping tests along the crest of Trail Ridge and 24 slug and bail tests at piezometers across the project study area.

AQUIFER PUMPING TESTS

TTL contracted with Hydro Geo Chem, Inc. (HGC) of Phoenix, Arizona for assistance in design, data collection for the two pumping tests, and analysis of the pumping test data. Included in this report are figures depicting the location of each pumping test area, boring logs and well construction diagrams for pumping/ observation wells, and HGC’s report analyzing the pumping tests.

Pumping Well Installations

In December 2018, TTL subcontracted Partridge Well Drilling Company, Inc. (Partridge) of Jacksonville, Florida to install two (2) pumping wells (PWA and PWB) within the project study area (Figure 3). The northernmost pumping well on the eastern crest of Trail Ridge was designated PWA and the southernmost well on the western crest of Trail Ridge was designated PWB. The logic for the pumping test locations along Trail Ridge was that the ridge represents a hydrologic divide between drainage to the Okefenokee Swamp to the west and drainage to the St. Mary’s River to the east. Exploratory borings (OWAEB and OWBEB) were advanced near the proposed pumping well locations to confirm target depths to the top of the Hawthorn Group. Each pumping well was installed to a depth of approximately 115 feet below ground surface (bgs). TTL’s on-site geologist was present during the drilling activities to supervise well installations for PWA and PWB.

Prior to initiating drilling, a mud pit for storing and circulating drilling mud was excavated near each pumping well boring. The soils excavated from the pits were temporarily stockpiled adjacent to each pit. The dimensions of each mud pit were approximately 8 feet wide by 10 feet long by 4 feet deep. On December 10, 2018 drilling commenced utilizing a truck-mounted mud-rotary drilling rig equipped with a 12-inch diameter roller/tri-cone drill bit. Once each borehole was drilled to a depth of 115 feet bgs, 60 feet of 6-inch diameter, 0.020-inch machine slotted PVC screen was installed from 55 feet to 115 feet bgs. A 6-inch diameter solid PVC casing was installed from the top of the screen to land surface. All screen and solid casing were flush-thread scheduled 40 PVC. A 16/30 silica sand was then placed from the bottom of the borehole to five feet above the top of the well screen (50 feet bgs). A five-foot bentonite plug was placed on top of the sand pack, and the remainder of the borehole annulus from the top of the bentonite seal to land surface was grouted with a cement/bentonite mixture. After grouting, the cement/bentonite mixture was allowed to cure for a minimum of twenty-four (24) hours. Next, each well was initially an partially developed by Partridge at an approximate rate of 150 gallons per minute (gpm) using an air-lift method. Once installation of the pumping wells was completed, the drilling mud was pumped from the mud pits and each pit was backfilled with the nearby stockpiled soils. Following the initial development efforts, each pumping well was subsequently redeveloped by Donald Smith Company using a submersible pump at pumping rates ranging from 150 to 300 gpm.

Observation Well Installation

During November 2018 through January 2019, Betts provided drilling services for the installation of 22 observations wells at the site. Eleven (11) observation wells were constructed adjacent to pumping wells PWA and PWB, respectively. These observation wells were installed to depths and distances from the pumping wells listed in Table 1.

The observation wells were installed using a Terra-Sonic Rig equipped with 6-inch diameter outer casing and a 4-inch diameter 10-foot long core barrel. Soil samples were collected continuously from each borehole for the observation wells. TTL's on-site geologist was present during drilling activities to describe soils recovered from each boring and supervise well installations.

With the exception of OWA3BS, OWA4BS, OWA5BS, OWB3BS, OWB4BS, and OWB5BS, each observation well was constructed with 10-foot sections of 2-inch diameter 0.010-inch slotted PVC screen with attached PVC riser. A natural sand pack was allowed to cave-in around the annulus between the PVC screen and the borehole wall from termination depth to two feet above the top of screen. A 2-foot bentonite plug was placed on top of natural sand pack and a Portland cement/bentonite mixture was placed from the top of the bentonite plug up to about 0.5-foot bgs. Permanent flush-mount protective covers and concrete pads were installed for surface protection at each observation wells. Observation well construction details are provided in Table 2.

Observation wells OWA3BS, OWA4BS, OWA5BS, OWB3BS, OWB4BS, and OWB5BS were constructed with five-foot sections of 2-inch diameter, 0.010-inch slotted PVC screen with attach PVC riser. A natural sand pack was allowed to cave-in around the annulus between the PVC screen/riser and the borehole wall from termination depth to ground surface. A flush-mounted, steel, protective cover was installed at the surface of each piezometer in a 2-foot by 2-foot concrete pad, and a locking, water-tight cap was placed in the top of each 2-inch casing. Pumping wells and observation are shown on Figures 4 and 5. Boring logs for pumping and observation wells are provided in Appendix A.

Following installation activities, each observation well was developed using a 12-volt submersible pump. Each observation well was developed until its turbidity was less than 10 nephelometric turbidity units (NTU) and/or until the extracted groundwater appeared to be relatively free of sediment. A cumulative of about 1,673 gallons and 2,019 gallons of groundwater were developed from the observation wells at pump areas A and B, respectively.

Aquifer Pumping Tests

In order to further evaluate surficial aquifer characteristics at the Twin Pines site, two independent pumping tests were performed within the project area. On February 14 and 15, 2019, Level-Troll 700 pressure transducers were installed at the pumping wells and observation wells for continuous monitoring of water-level data prior to and during the pumping tests. In addition to the transducers installed in the wells, BaroTroll transducers were placed near each pumping well to constantly record barometric pressure at land surface prior to and during the pumping tests.

Between February 19 and 22, 2019, two 24-hour pumping tests were conducted at Pumping Well A and Pumping Well B (Figure 3). Each pumping test was comprised of three steps:

Pump Test A	Pump Rate (gallons per minute)	Pump Test B	Pump Rate (gallons per minute)
Step 1 (2 hours)	75	Step 1 (2 hours)	50
Step 2 (2 hours)	150	Step 2 (2 hours)	75
Step 3 (20 hours)	250	Step 3 (20 hours)	120

At each pumping well, Donald Smith Company installed an electric-submersible pump connected to metal discharge piping. The discharge piping at the wellhead was equipped with a flow meter and gate valve. An 8-inch diameter 1,000-foot long flexible hose was attached to the metal discharge piping at each wellhead. These discharge hoses were used to direct groundwater away from the pumping wells and minimize impacts to the pumping tests from infiltrating discharge water. The discharge line for the pumping well PWA was oriented to the east-northeast and the discharge line for the pumping well PWB was oriented to the northwest.

Personnel with TTL and HGC were on-site for the full duration (24 hours per day) of each pumping test. Additionally, field verification of water-level monitoring using tape-down measurements was also performed by TTL personnel as backup for the transducer measurements. Upon completion of the tests, the transducer data was downloaded and submitted, along with the field verification of water-level monitoring data, to HGC for analysis. A complete copy of HGC's pumping test report is included in Appendix B.

Slug and Bail Tests

To estimate the horizontal hydraulic conductivity of the surficial aquifer, slug and bail tests were performed in the 24 piezometers within the project study area (Figure 6 and Table 3). Slug and bail tests were conducted by creating an instantaneous change in water level in the piezometer and recording the rate of groundwater recovery relative to the initial measured water level. The following testing equipment was rented from In-Situ, Inc. in Fort Collins, Colorado for performance of each test:

- SLG 3-segment thermoplastic mandrel with known displacement values for each segment was used to displace water during the slug and bail tests.
- Level-Troll 700 pressure transducers were employed to record changes in water levels during the slug and bail tests.

Upon completion of the tests, the test data was downloaded from the transducers and submitted to HGC in Phoenix, Arizona for calculation of the horizontal hydraulic conductivity and specific storage values. HGC evaluated the data using AQTESOLV® Pro software. The rate of recovery versus time data was evaluated using the *Hyder et al. (1994) Solution of a Slug Test in an Unconfined Aquifer (KGS Model)* and the *Bower and Rice (1976) solution for a Slug Test in an Unconfined Aquifer*.

RESULTS

Pumping Test Results

Pumping test results are summarized in Table 4 (Pumping Well A) and Table 5 (Pumping Well B). HGC's interpretation of pumping test data indicated that the results of both qualitative and quantitative analyses are consistent with the following observations/conclusions:

- Results of quantitative analysis indicate that both pumping wells are efficient and properly designed and developed (negligible skin effects or non-linear losses).
- Transmissivity (T) estimates are generally higher at the pumping well PWA compared to the pumping well PWB site, consistent with the larger achievable pumping rates at pumping well PWA site. Except for a few outliers, horizontal hydraulic conductivity (Kh) estimates computed from T estimates generally range from several ft/day to nearly 20 ft/day for pumping well PWA, and from a few ft/day to as much as 11 ft/day for pumping well PWB, with some values exceeding 50 ft/day. HGC considered these high values to be unreliable; however, they are close to values determined from slug and bail tests conducted in the project study area (values of up to 75.1 ft/day, see below).
- Heterogeneity possibly resulting from non-horizontal structure within the sands may be present within the pumped aquifer. Such heterogeneity may result in more direct connection between the pumping and shallow observation wells at larger distances from the pumping wells.
- Such heterogeneity would be consistent with the substantial increase in the ratio of shallow observation well drawdowns to deep observation well drawdowns with distance from the pumping wells, and the unexpected increase in this ratio above 1.0 at the more distant observation well nests.
- Flattening of pumping well and shallow observation well drawdowns is consistent with another (presumably shallow) source of water, either local wetlands or vertical leakage from the shallowest groundwater through the shallow 'black sand', or both. Substantially less flattening of the deep observation well drawdowns indicates that the deeper portion of the aquifer is less impacted by the additional source of water.

Pumping Test PWA

For pumping test PWA, estimates of T and storage coefficient (S) from pumping well PWA data range from 1,490 ft^2/day to 1,967 ft^2/day and from 3.5×10^{-4} to 1.1×10^{-2}. Although estimates of T from observation well data range from approximately 1 ft^2/day to 2,288 ft^2/day, the majority of estimates are lower than for the pumping well and average 875 ft^2/day. Estimates of S from observation well data range from approximately 1.6×10^{-5} to 1.7×10^{-2}; estimates of Kh range from <1 to 20 ft/day; estimates of Kv range from 0.06 ft/day to 1.8 ft/day; and estimates of aquitard Kv range from 2.4×10^{-6} ft/day to 0.75 ft/day. The lowest T of 1 ft^2/day was derived from one interpretation of data from OWA-3D, where, due to non-uniqueness, T estimates from alternate interpretations ranged from 1 ft^2/day to 1700 ft^2/day.

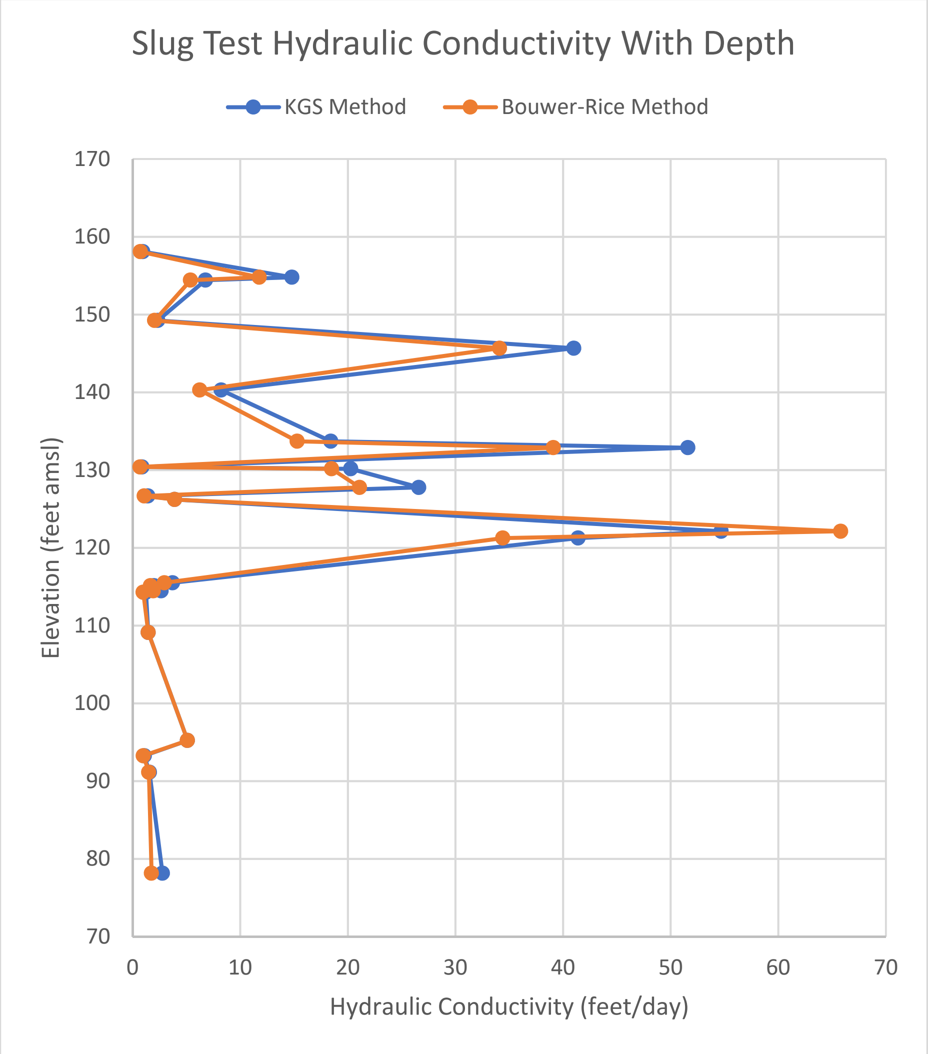
Pumping Test PWB

For pumping test PWB, estimates of T and S from pumping well PWB data range from 530 ft^2/day to 697 ft^2/day and from 2.4×10^{-3} to 0.11. T estimates from the shallowest water table well data that range from 5,455 ft^2/day to 9,500 ft^2/day. Excluding these estimates, observation well data yield T estimates ranging from approximately 53 ft^2/day to 1,100 ft^2/day; however, the majority of the estimates are lower than for the pumping well and average 432 ft^2/day. Estimates of S from observation well data range from approximately 1×10^{-10} to 5×10^{-3}; estimates of Kh range from <1 to 11 ft/day; estimates of Kv range from 8.6×10^{-5} ft/day to 1.5 ft/day; and estimates of aquitard Kv range from 1.1×10^{-6} ft/day to 0.3 ft/day.

Slug and Bail Tests

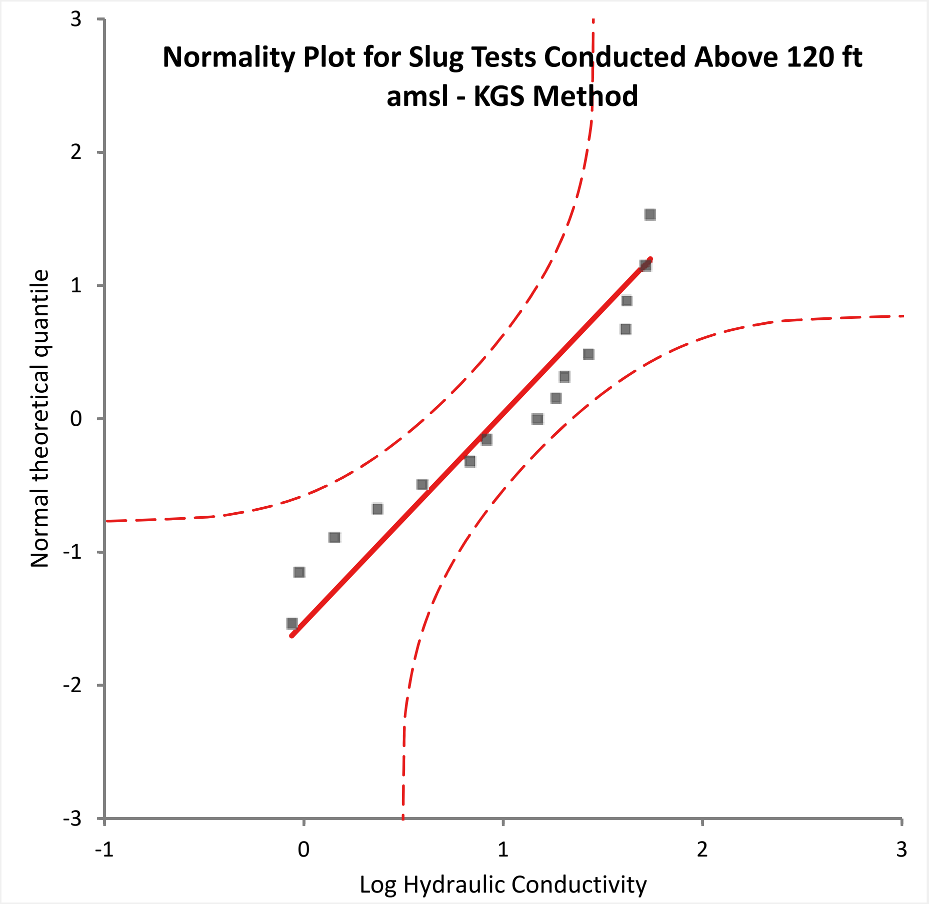
The slug and bail tests were interpreted by HGC (Appendix C). Slug test data were analyzed using the Kansas Geological Survey (KGS) method (Hyder et al., 1994) and the Bouwer-Rice method (Bouwer and Rice, 1976). The results from the 24 slug and bail tests performed in the study area are shown in Table 6 and Figures 7 and 8. Both methods produced similar estimates of hydraulic conductivity. Hydraulic conductivities estimated using the KGS method range from 0.2 to 75.1 ft/day and average 12.2 ft/day. The Bouwer-Rice method yields a hydraulic conductivity range of 0.24 to 54.7 ft/day and an average of 13.5 ft/day. Estimates of aquifer specific storage from the KGS method range from 3.8 x 10^{-20} to 2.2 x 10^{-3} 1/ft and average specific storage of 1.6 x 10^{-4} 1/ft.

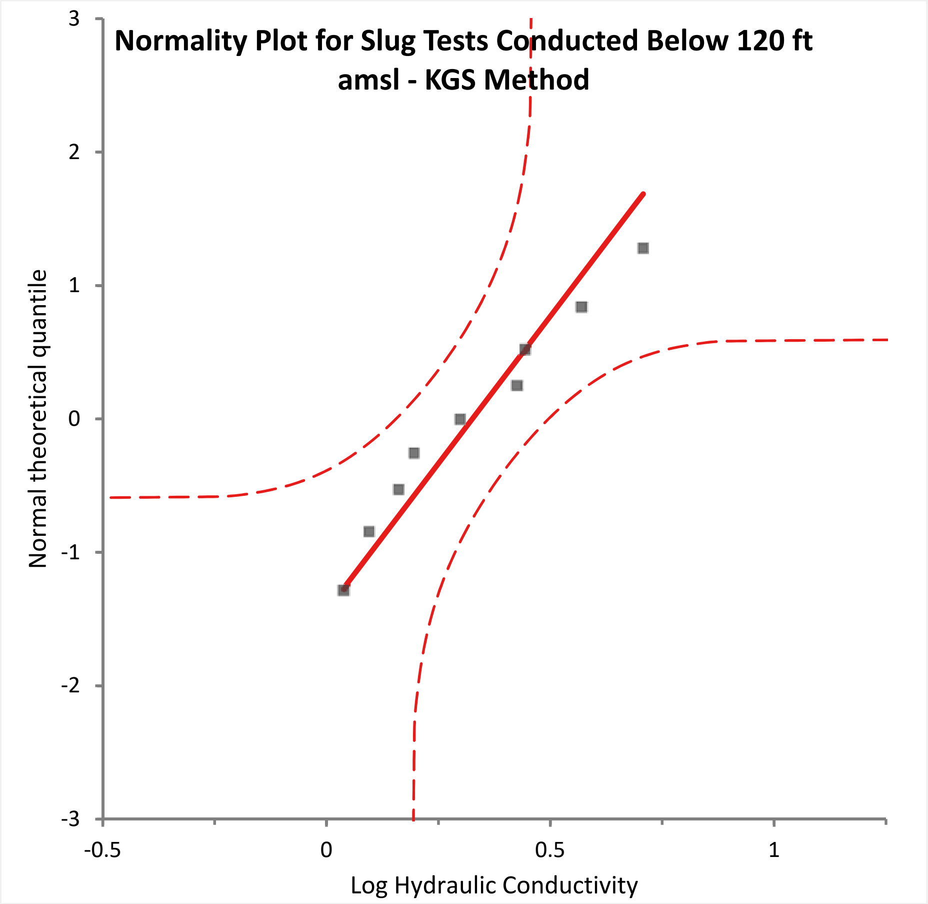
The averages of the hydraulic conductivity estimated from a slug test and corresponding bail test at each well show a distinct vertical pattern, with lower hydraulic conductivities found below an elevation of 120 ft amsl and much higher hydraulic conductivities found above 120 ft amsl.



Holt et al. (2019) showed that the subsurface lithology is dominated by unconsolidated sands. They also found that humate-cemented sands are more common above 120 ft amsl and that silty-clayey sand, clayey sand, and clay are more common below 120 ft amsl. The vertical distribution of hydraulic conductivity estimated from slug tests reflects the occurrence of clays below 120 ft amsl. The data presented here suggest that there are two distributions of hydraulic conductivity: one for elevations above 120 ft amsl and another for elevations below 120 ft amsl.

The log of the averaged (slug and bail) hydraulic conductivity for both the upper and lower elevations appears to be log normal for both types of estimates (KGS and Bouwer Rice). The geometric means for the upper elevations are 9.4 and 7.9 ft/day for hydraulic conductivities estimated using the KGS and Bouwer-Rice methods, respectively. In the lower elevations, the geometric means are 2.1 and 1.8 ft/day for the KGS and Bouwer-Rice methods, respectively. Note: only the results for hydraulic conductivities for the KGS method are shown, as the results for hydraulic conductivities determined using the Bouwer-Rice method are similar.





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FIGURES

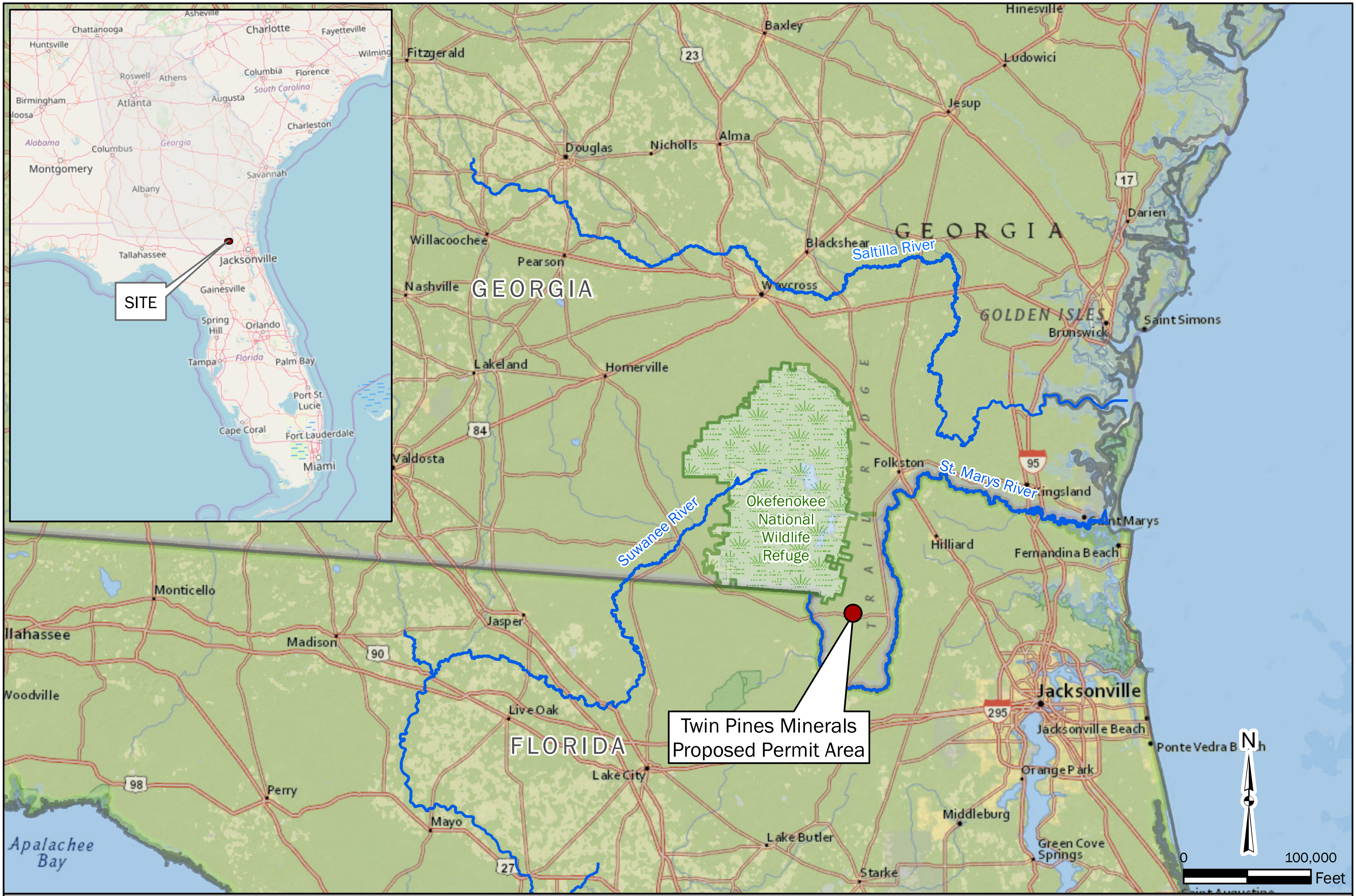

FIGURE 1: LOCATION OF THE PROPOSED TWIN PINES MINE

TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

INSET BASEMAP: Open Street Map. BASEMAP: National Geographic World Map.

DRAWN BY: DEK

CHECKED BY: JMT

DRAWING DATE: 10/28/2019

REVISION DATE: N/A

TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 100,000 ft

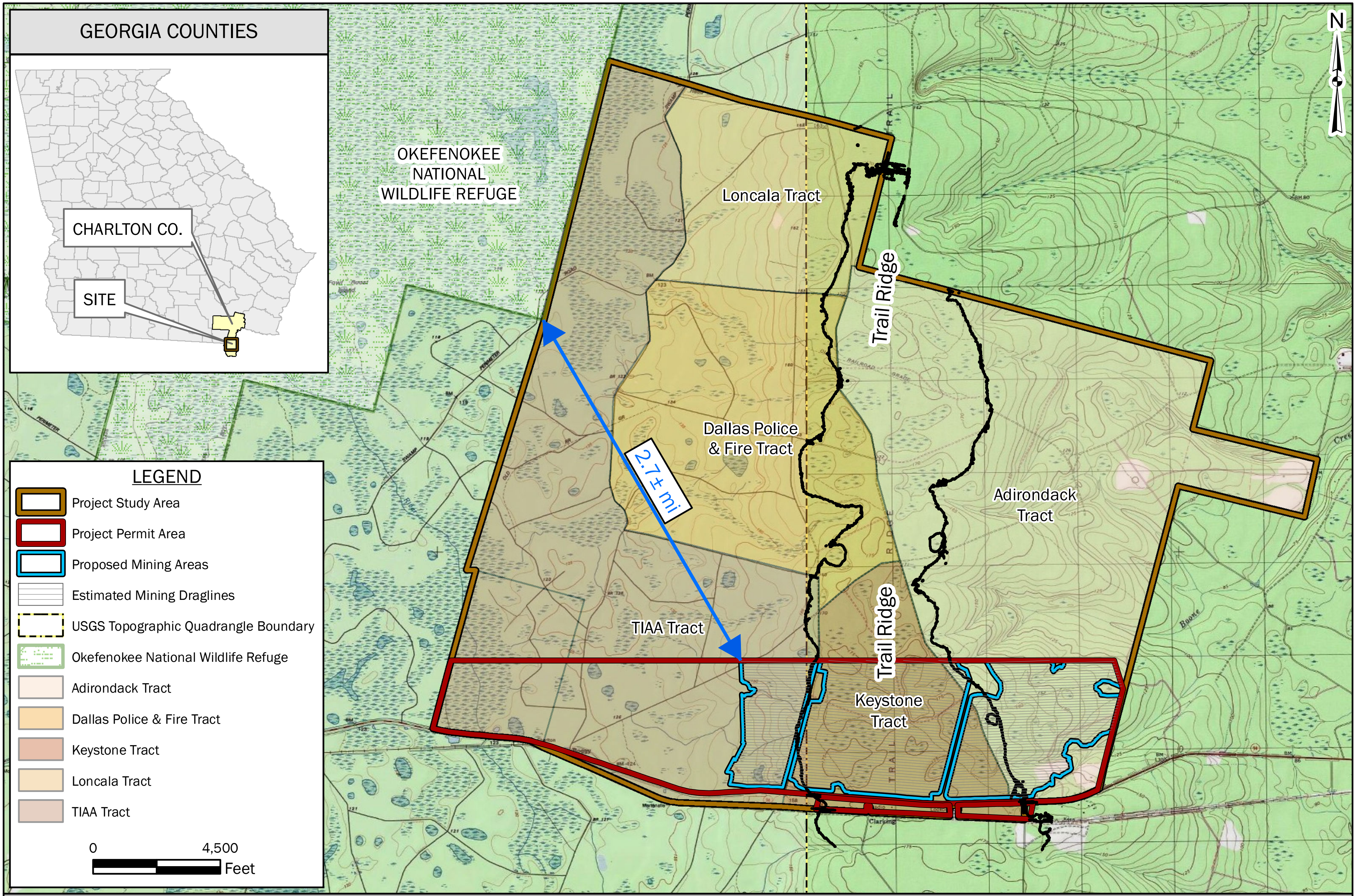

FIGURE 2: PROJECT STUDY & PROPOSED PERMIT AREA

TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: USGS 7.5 Minute Quadrangle Map, Florida & Georgia, (West) Moniac 1968 (10-ft Contour Interval), (East) Saint George 1982 (5-ft Contour Interval).

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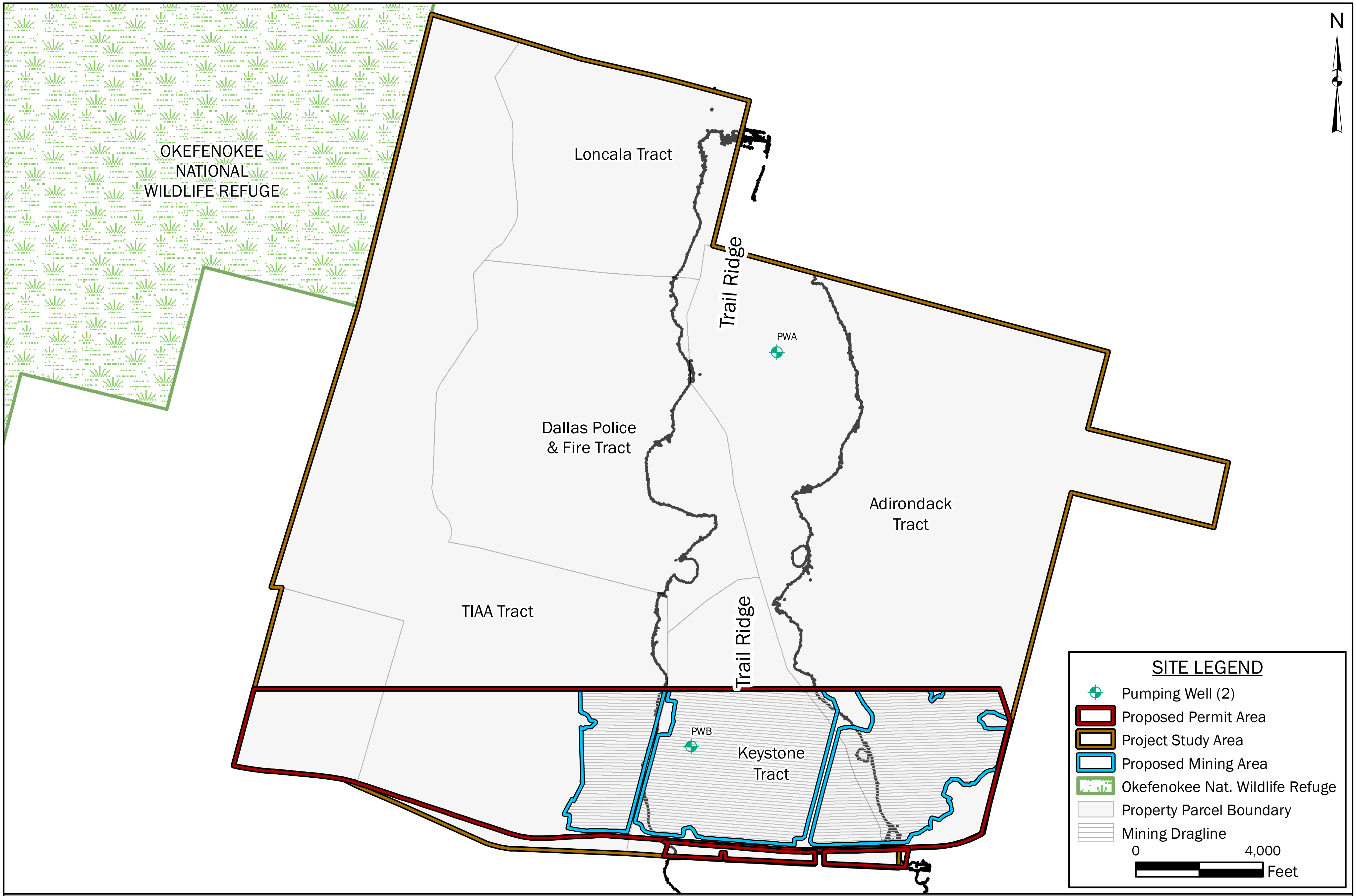

FIGURE 3: PUMPING WELL LOCATION MAP

TWIN PINES MINERALS

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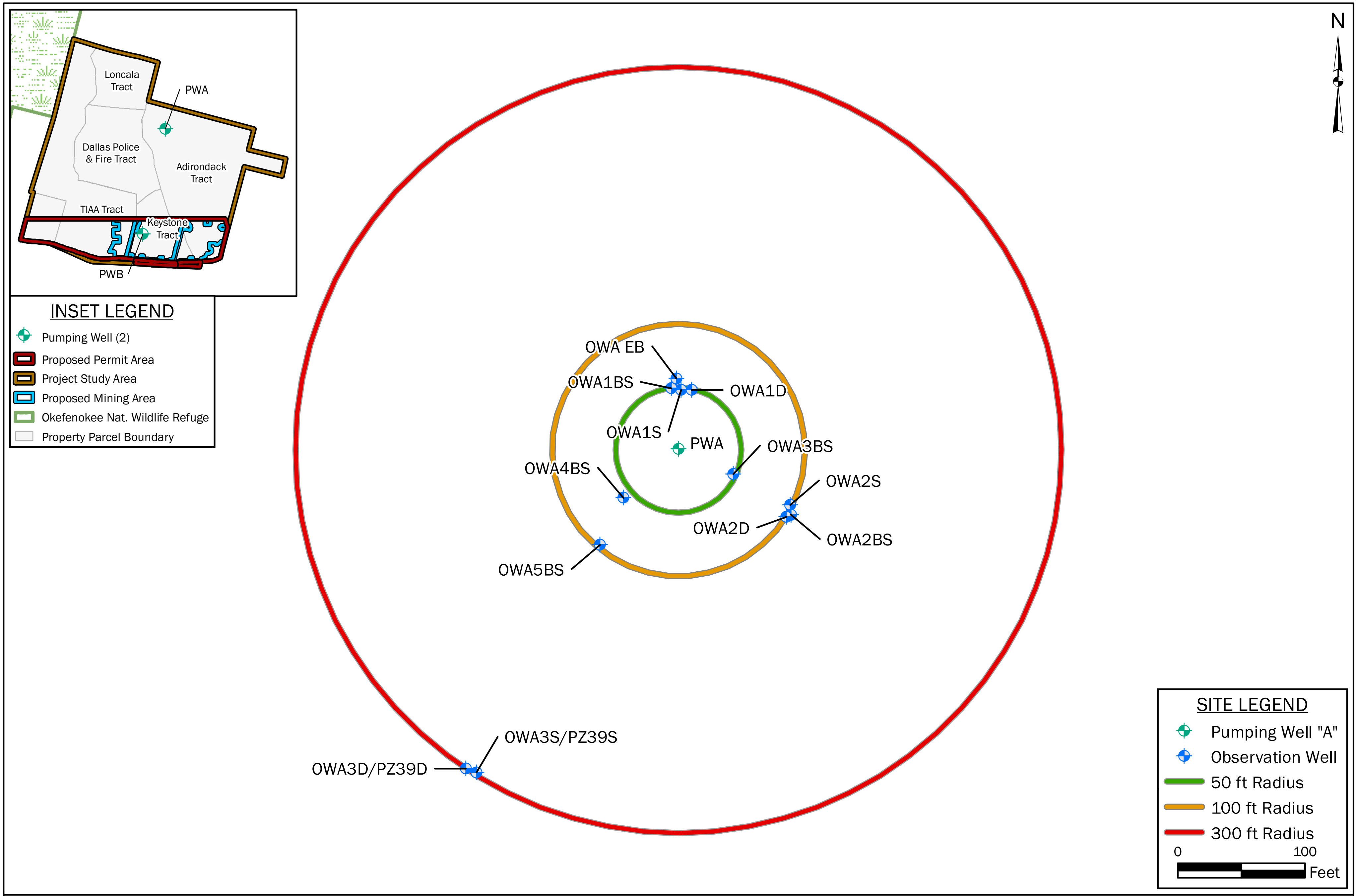

FIGURE 4: PUMPING WELL "A" LOCATION MAP

TWIN PINES MINERALS

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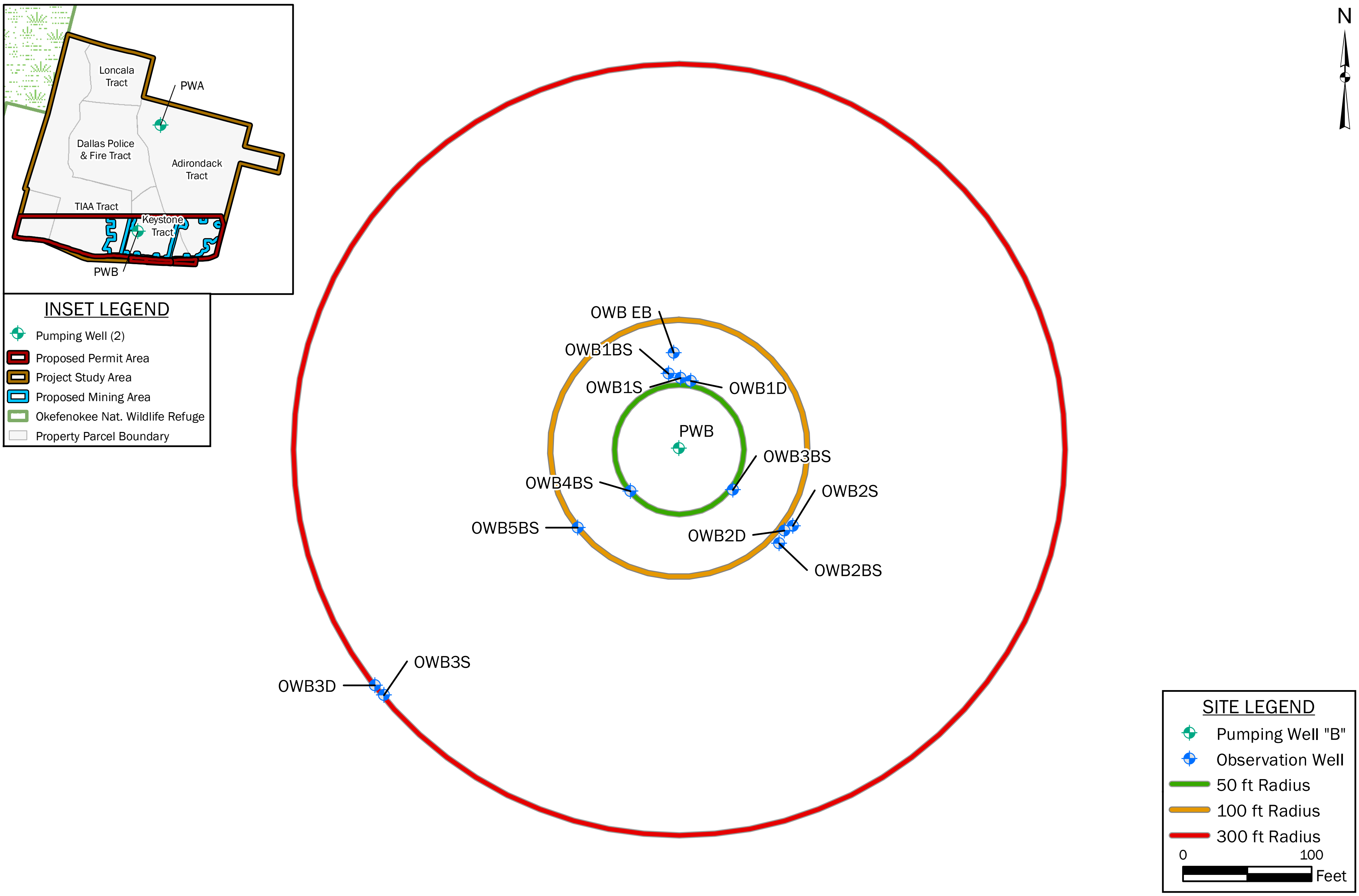

FIGURE 5: PUMPING WELL "B" LOCATION MAP

TWIN PINES MINERALS

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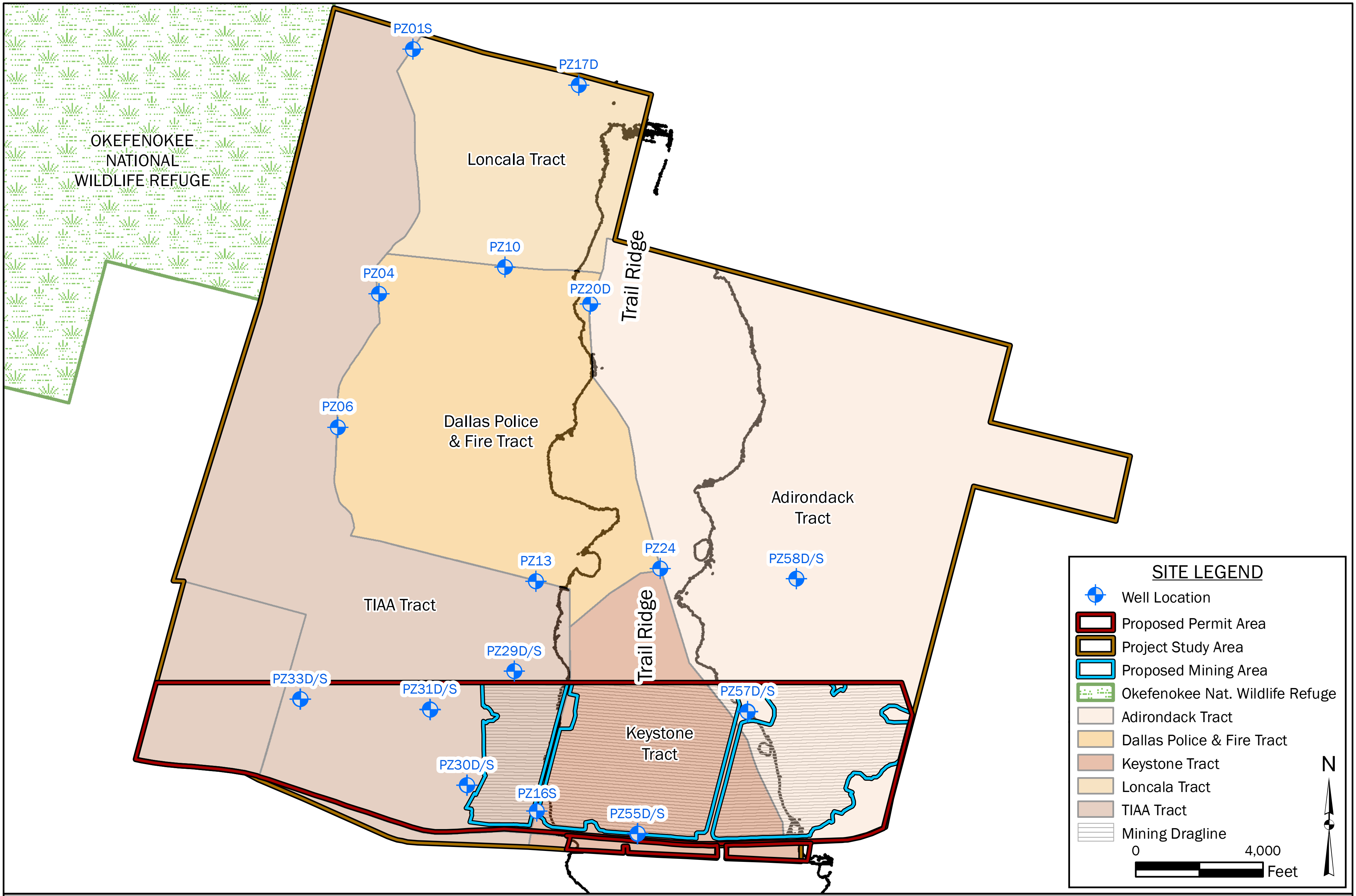

FIGURE 6: SLUG & BAIL TEST PIEZOMETER LOCATION MAP

TWIN PINES MINERALS

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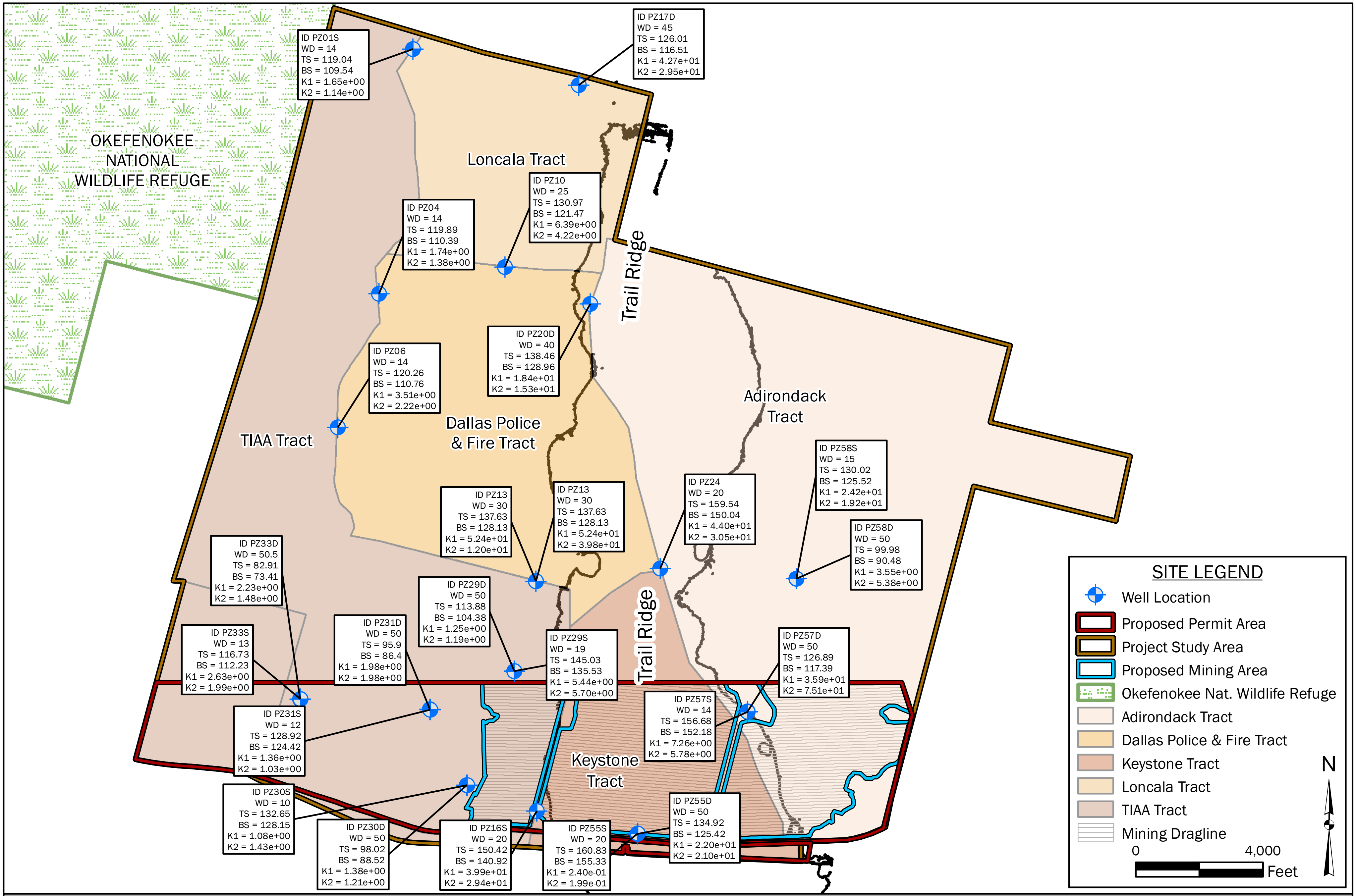

FIGURE 7: HYDRAULIC CONDUCTIVITY (SLUG TESTS)

TWIN PINES MINERALS

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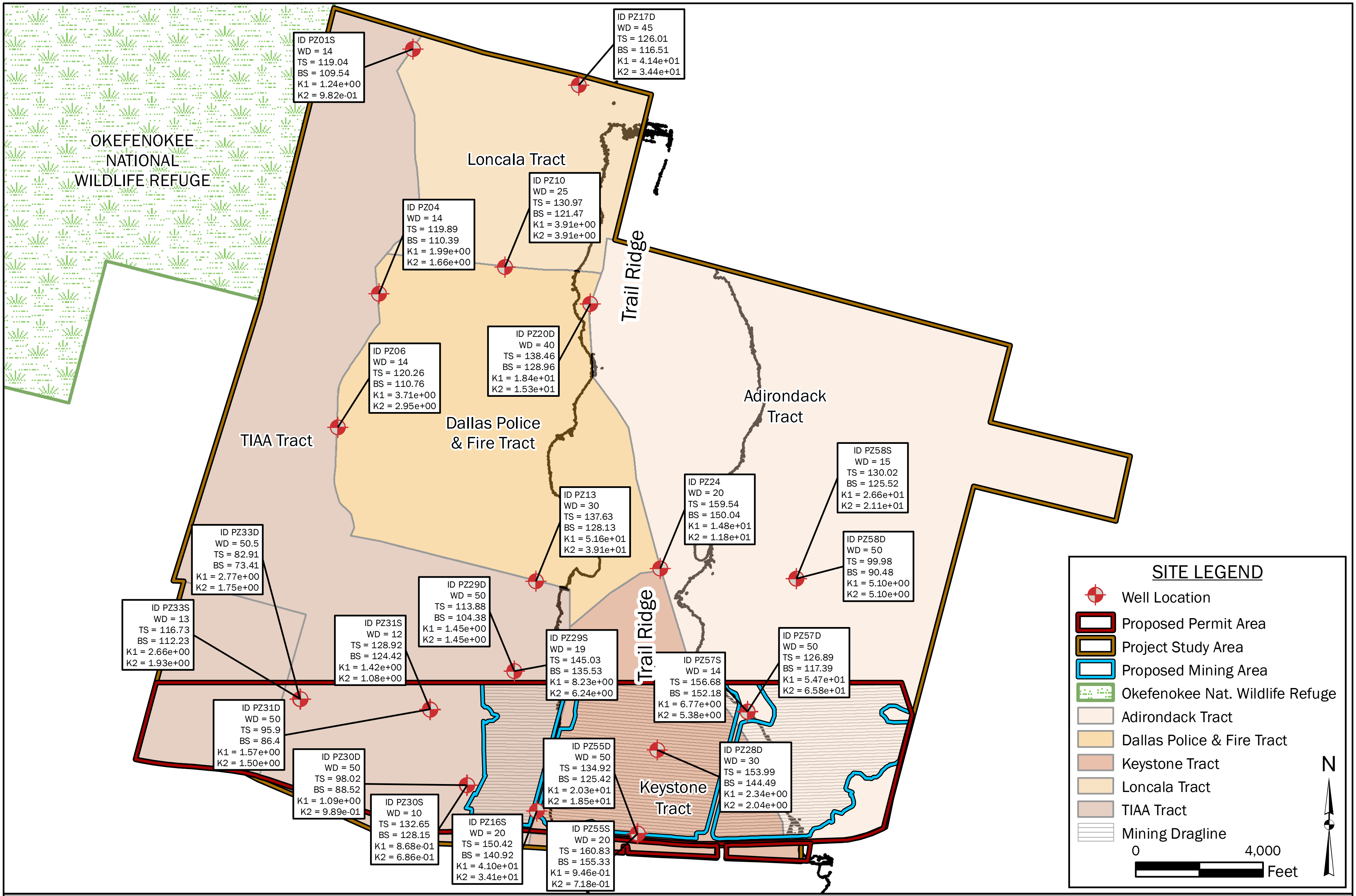

FIGURE 8: HYDRAULIC CONDUCTIVITY (BAIL TESTS)

TWIN PINES MINERALS

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TABLES

Table 1. Summary of Observation Well Construction Depths and Distances from Pumping Wells PWA and PWB. Hydrologic Field Characterization at Twin Pines Mine; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Pumping Well PWA		
Observation Well	**Distance from PWA (feet)**	**Well Depth (ft bgs)**
OWA1BS	50	12
OWA1S	50	35
OWA1D	50	90
OWA3BS	50	12
OWA4BS	50	12
OWA2BS	100	12
OWA2S	100	35
OWA2D	100	90
OWA5BS	100	12
OWA3S/PZ39S	300	35
OWA3D/PZ39D	300	90
Pumping Well PWB		
Observation Well	**Distance from PWB (feet)**	**Well Depth (feet bgs)**
OWB1BS	50	12
OWB1S	50	35
OWB1D	50	90
OWB3BS	50	12
OWB4BS	50	12
OWB2BS	100	12
OWB2S	100	35
OWB2D	100	90
OWB5BS	100	12
OWB3S	300	35
OWB3D	300	90

Table 2. Well Construction Summary Table; Hydrologic Field Characteristics at Twin Pines Mine; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Well I.D.	Installation Start Date	Screened Interval (feet bgs[1])	Natural Fill Sand Pack (feet bgs)	Bentonite Plug (feet bgs)	Portland Cement Grout (feet bgs)	Construction Depth of Piezometer (feet bgs)	Total Boring Depth (feet bgs)
Pumping & Observation Wells							
OWA1S	11/9/2018	35-25	35-22	22-20	20-0.5	35	35
OWA1D	11/9/2018	90-80	90-76	76-74	74-0	90	90
OWA1BS	12/11/2018	12-2	12-1	1-0.5	--	12	12
OWA2S	11/14/2018	35-25	35-22	22-20	20-0.5	35	35
OWA2D	11/13/2018	90-80	90-76	76-74	74-0	90	90
OWA2BS	12/7/2018	12-2	12-1	1-0.5	--	12	12
OWA3BS	1/30/2019	12-7	12-0	--	--	12	12
OWA4BS	1/30/2019	12-7	12-0	--	--	12	12
OWA5BS	1/30/2019	12-7	12-0	--	--	12	12
PWA	12/20/2018	115-55	115-45	45-40	40-0	115	115
OWB1S	11/27/2018	35-25	35-22	22-20	20-0.5	35	35
OWB1D	11/27/2018	90-80	90-76	76-74	74-0	90	90
OWB1BS	12/7/2018	12-2	12-1	1-0.5	--	12	12
OWB2S	1130/18	35-25	35-22	22-20	20-0.5	35	35
OWB2D	11/28/2018	90-80	90-76	76-74	74-0	90	90
OWB2BS	12/7/2018	12-2	12-1	1-0.5	--	12	12
OWB3S	12/5/2018	35-25	35-22	22-20	20-0.5	35	35
OWB3D	12/5/2018	90-80	90-76	76-74	74-0	90	90
OWB3BS	1/30/2019	12-7	12-0	--	--	12	12
OWB4BS	1/30/2019	12-7	12-0	--	--	12	12
OWB5BS	1/30/2019	12-7	12-0	--	--	12	12
PWB	12/10/2018	115-55	115-45	45-40	40-0	115	115

[1] Below ground surface

[2] Not applicable or missing data

[3] Undisturbed sample borings converted to piezometers for downhole geophysical survey

Table 3. Slug and Bail Test Location Summary. Hydrologic Field Characterization at Twin Pines Mine; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Piezometer	Date of Test
PZ01S	10/10/18
PZ04	10/10/18
PZ06	10/10/18
PZ10	10/10/18
PZ13	10/10/18
PZ16S	10/11/8
PZ17D	10/11/18
PZ20D	10/11/18
PZ24	10/11/18
PZ28D	10/10/18
PZ29S/D	5/16/19
PZ30S/D	5/16/19
PZ31S/D	5/16/19
PZ33S/D	5/16/19
PZ55S/D	5/16/19
PZ57S/D	5/16/19
PZ58S/D	5/16/19

S/D = Shallow and Deep Piezometer

TABLE 4
PWA Aquifer Test Hydraulic Parameter Estimates

Observation Well (s)	Bottom of Screen Depth (ft)	Solution	T (ft^2/day)	S	Specific Yield	Kv (ft/day)	Kv aquitard (ft/day)	b (ft)	Kh (ft/day)	recom-mended	Comment
PW-A	115	Neuman Unconfined	1967	3.5E-04	2.9E-03	0.2	NA	115	17.1	x	
PW-A	115	Vert. Anisotropic Leaky	1490	1.1E-02	NA	1.0	0.40	115	13.0	x	analysis using WHIP
OWA-1D	90	Neuman Unconfined	1475	8.5E-03	0.50	0.3	NA	115	12.8	x	
OWA-2D	90	Neuman Unconfined	1319	4.8E-03	2.9E-02	0.3	NA	115	11.5	x	
OWA-3D	90	Neuman Unconfined	2288	1.7E-02	0.03	1.08	NA	115	19.9	x	
OWA-1S	35	Neuman Unconfined	1351	4.3E-03	0.50	1.8	NA	115	11.7	x	
OWA-2S	35	Neuman Unconfined	1820	3.4E-03	0.50	1.6	NA	115	15.8		
OWA-3S	35	Neuman Unconfined	680	5.5E-05	2.2E-02	0.06	NA	115	5.9	x	
OWA-1D	90	[1]Neuman-Witherspoon	914	2.2E-03	NA	NA	3.7E-06	100	9.1		T2=1.44e8 ft^2/d; S2=1e-10
OWA-1D	90	[1]Neuman-Witherspoon	356	7.3E-05	NA	NA	4.4E-01	100	3.6	x	T2=4170 ft2/d; S2=0.0149; improved fit
OWA-2D	90	[1]Neuman-Witherspoon	1017	1.2E-03	NA	NA	4.1E-06	100	10.2		T2=1.44e8 ft^2/d; S2=1e-10
OWA-2D	90	[1]Neuman-Witherspoon	422	8.8E-04	NA	NA	0.152	100	4.2	x	T2=4850 ft2/d; S2=1.01e-10; improved fit
OWA-3D	90	[1]Neuman-Witherspoon	1700	7.0E-03	NA	NA	6.8E-06	100	17.0		T2=1.44e8 ft^2/d; S2=2.7e-5
OWA-3D	90	[1]Neuman-Witherspoon	331	3.4E-03	NA	NA	0.383	100	3.3	x	T2=4272 ft2/d; S2=9.91e-3; improved fit
OWA-3D	90	[1]Neuman-Witherspoon	1.3	1.0E-04	NA	NA	0.396	100	0.013		T2=4520 ft^2/d; S2=0.005
OWA-1D	90	Vert. Anisotropic Leaky	360	1.6E-05	NA	0.70	0.68	100	3.6	x	analysis using WHIP; Ss aqt = 5.39e-3
OWA-1D	90	Vert. Anisotropic Leaky	543	1.4E-03	NA	1.01	0.32	100	5.4	x	fit recovery w/WHIP; Ss aqt = 5.04e-3
OWA-2D	90	Vert. Anisotropic Leaky	337	1.6E-05	NA	0.29	0.24	100	3.4	x	analysis using WHIP; Ss aqt = 2.01e-3
OWA-2D	90	Vert. Anisotropic Leaky	665	9.8E-04	NA	0.19	0.13	100	6.7	x	fit recovery w/WHIP; Ss aqt = 1.85e-3
OWA-3D	90	Vert. Anisotropic Leaky	323	1.6E-05	NA	0.17	0.17	100	3.2	x	analysis using WHIP; Ss aqt = 2.10e-3
OWA-1S	35	Vert. Anisotropic Leaky	592	1.6E-05	NA	0.8	0.73	100	5.9	x	analysis using WHIP; Ss aqt = 1.77e-3
OWA-2S	35	Vert. Anisotropic Leaky	354	1.6E-05	NA	0.4	0.67	100	3.5	x	analysis using WHIP; Ss aqt = 9.54e-4
OWA-3S	35	Vert. Anisotropic Leaky	326	1.6E-05	NA	0.11	0.05	100	3.3	x	analysis using WHIP; Ss aqt = 2.76e-5
OWA-1D/3D	90/90	Neuman Unconfined	946	1.2E-02	0.06	1.27	NA	115	8.2	x	
OWA-1D/3D	90/90	[1]Neuman-Witherspoon	596	9.8E-04	NA	NA	2.4E-06	100	6.0	x	T2=1.44e8 ft^2/d; S2=1e-10
OWA-1S/D	35/90	Neuman Unconfined	1136	1.1E-02	0.5	0.8	NA	115	9.9	x	
OWA-1S/D	35/90	Neuman Unconfined	1154	1.0E-02	0.25	0.8	NA	115	10.0		alt interp
OWA-1S/D	35/90	Neuman Unconfined	926	1.1E-02	0.50	1.6	NA	115	8.1		early time interp
OWA-2S/D	35/90	Neuman Unconfined	866	5.3E-03	3.3E-02	0.8	NA	115	7.5		
OWA-2S/D	35/90	Neuman Unconfined	1141	5.8E-03	0.50	1.0	NA	115	9.9		early time interp
OWA-2S/D	35/90	Neuman Unconfined	1319	4.8E-03	0.029	0.29	NA	115	11.5	x	alt interp
OWA-2S/D	35/90	Neuman Unconfined	1800	2.0E-03	0.50	1.6	NA	115	15.7		alt interp
OWA-1S/D	35/90	Vert. Anisotropic Leaky	355	1.6E-05	NA	0.5	0.75	100	3.6	x	analysis using WHIP; Ss aqt = 5.12e-3
OWA-2S/D	35/90	Vert. Anisotropic Leaky	329	1.6E-05	NA	0.1	0.30	100	3.3	x	analysis using WHIP; Ss aqt = 2.05e-3
OWA-1D/2D/3D	90/90/90	Neuman Unconfined	1307	7.7E-03	0.50	0.43	NA	115	11.4	x	
OWA-1D/2D/3D	90/90/90	[1]Neuman-Witherspoon	718	1.3E-03	NA	NA	2.9E-06	100	7.2	x	T2=1.44e8 ft^2/d; S2=1e-10

Notes:

[1] = leaky aquifer; partial penetration of wells not represented
T = Transmissivity in feet squared per day (ft2/day)
T2 = Transmissivity of unpumped aquifer
S = Storage coefficient
S2 = Storage coefficient of unpumped aquifer
Ss = Specific storage of aquitard (storage per foot of thickr
Kh = horizontal hydraulic conductivity in feet per day (ft/day) calculated as T/b
Kv =vertical hydraulic conductivity in feet per day (ft/day)
b = Assumed aquifer thickness in feet

TABLE 5
PWB Aquifer Test Hydraulic Parameter Estimates

Observation Well (s)	Bottom of Screen Depth (ft)	Solution	T (ft^2/day)	S	Specific Yield	Kv (ft/day)	Kv aquitard (ft/day)	b (feet)	Kh (ft/day)	recom-mended	Comment
PW-B	115	Neuman Unconfined	697	2.42E-03	1.00E-03	0.61	NA	115	6.1	x	
PW-B	115	Vert. Anisotropic Leaky	530	0.11	NA	0.55	0.10	115	4.6	x	analysis using WHIP; Ss aqt = 0.01
OWB-1D	90	Neuman Unconfined	478	2.92E-03	1.00E-03	1.42	NA	115	4.2		
OWB-1D	90	Neuman Unconfined	530	4.96E-03	1.00E-03	0.47	NA	115	4.6		alternate interp; improved fit
OWB-1D	90	Neuman Unconfined	901	3.20E-03	1.00E-03	9.29E-03	NA	115	7.8	x	alternate interp; additionally improved fit
OWB-2D	90	Neuman Unconfined	442	2.95E-03	1.00E-03	0.88	NA	115	3.8		
OWB-2D	90	Neuman Unconfined	808	4.78E-03	0.25	1.79E-02	NA	115	7.0	x	alternate interp; improved fit
OWB-3D	90	Neuman Unconfined	475	1.32E-03	0.50	4.34E-02	NA	115	4.1	x	
OWB-3D	90	Neuman Unconfined	674	3.43E-03	0.25	9.20E-03	NA	115	5.9		alternate interp; poorer fit
OWB-1S	35	Neuman Unconfined	224	1.19E-04	4.58E-03	2.12E-02	NA	115	1.9	x	
OWB-2S	35	Neuman Unconfined	221	2.96E-05	1.13E-03	5.17E-03	NA	115	1.9	x	
OWB-3S	35	Neuman Unconfined	246	3.09E-05	1.00E-03	4.88E-03	NA	115	2.1	x	
OWB-2BS	12	Neuman Unconfined	5455	1.37E-04	1.78E-02	1.02E-02	NA	115	47.4		unreasonably high T
OWB-3BS	12	Neuman Unconfined	6148	5.00E-05	2.00E-03	3.50E-03	NA	115	53.5		unreasonably high T
OWB-4BS	12	Neuman Unconfined	6918	4.84E-05	0.25	3.50E-03	NA	115	60.2		unreasonably high T
OWB-5BS	12	Neuman Unconfined	9499	3.75E-05	0.25	3.50E-03	NA	115	82.6		unreasonably high T
OWB-1D	90	[1]Neuman-Witherspoon	445	1.79E-03	NA	NA	5.41E-03	100	4.5	x	T2=1.44e8 ft^2/d; S2=1.0
OWB-2D	90	[1]Neuman-Witherspoon	405	2.34E-03	NA	NA	7.70E-03	100	4.1	x	T2=1.44e8 ft^2/d; S2=1.0
OWB-3D	90	[1]Neuman-Witherspoon	285	1.32E-03	NA	NA	1.14E-06	100	2.9		T2=1.44e8 ft^2/d; S2=6.03e-9
OWB-3D	90	[1]Neuman-Witherspoon	211	1.11E-03	NA	NA	1.40E-02	100	2.1	x	alt. interp; T2=1050 ft^2/d; S2=1.0e-10
OWB-3D	90	[1]Neuman-Witherspoon	52.9	1.38E-04	NA	NA	2.88E-02	100	0.5	x	alt. interp.; T2=671 ft^2/d; S2=1.39e-3
OWB-3BS	12	[1]Neuman-Witherspoon	1100	4.23E-04	NA	NA	0.309	100	11.0		T2=5.7e4 ft^2/d; S2=0.011, high T
OWB-4BS	12	[1]Neuman-Witherspoon	204	1.16E-05	NA	NA	2.16E-03	100	2.0	x	T2=2.56e5 ft^2/d; S2=1.19e-5
OWB-5BS	12	[1]Neuman-Witherspoon	206	1.16E-05	NA	NA	1.97E-03	100	2.1	x	T2=3.67e5 ft^2/d; S2=1.9e-5
OWB-1D	90	Vert. Anisotropic Leaky	201	1.05E-05	NA	0.367	6.16E-02	100	2.0	x	analysis using WHIP; Ss aqt = 0.0115
OWB-2D	90	Vert. Anisotropic Leaky	134	1.06E-05	NA	0.477	7.25E-02	100	1.3	x	analysis using WHIP; Ss aqt = 1.88e-3
OWB-3D	90	Vert. Anisotropic Leaky	67	3.56E-05	NA	8.92E-02	1.61E-02	100	0.7	x	analysis using WHIP; Ssaqt = 4.30e-4
OWB-1S	35	Vert. Anisotropic Leaky	121	1.05E-05	NA	0.955	0.299	100	1.2	x	analysis using WHIP; Ss aqt = 1.42e-3
OWB-2S	35	Vert. Anisotropic Leaky	174	1.00E-05	NA	1.00	8.26E-02	100	1.7	x	analysis using WHIP; Ss aqt = 5.84e-4
OWB-3S	35	Vert. Anisotropic Leaky	312	1.07E-10	NA	0.252	1.77E-03	100	3.1	x	analysis using WHIP; Ss aqt = 5.04e-4
OWB-1D/-2D	90/90	Neuman Unconfined	960	3.31E-03	1.00E-03	8.62E-05	NA	115	8.3	x	
OWB-1D/-3D	90/90	Neuman Unconfined	924	3.01E-03	0.25	3.00E-03	NA	115	8.0	x	
OWB-1S/-1D	35/90	Neuman Unconfined	593	1.00E-03	1.00E-03	1.51	NA	115	5.2	x	
OWB-1S/-1D	35/90	Neuman Unconfined	575	1.30E-03	1.00E-03	1.51	NA	115	5.0	x	alternate interp
OWB-2S/-2BS	35/12	[1]Neuman-Witherspoon	517	1.13E-03	NA	NA	1.80E-02	100	5.2	x	T2=5.03e4 ft^2/d; S2=2.59e-3
OWB-1S/-1D	35/90	Vert. Anisotropic Leaky	120	1.05E-05	NA	0.958	0.276	100	1.2	x	analysis using WHIP; Ss aqt = 2.04e-3

Notes:

[1] = leaky aquifer; partial penetration of wells not represented
T = Transmissivity in feet squared per day (ft2/day)
T2 = Transmissivity of unpumped aquifer
S = Storage coefficient
S2 = Storage coefficient of unpumped aquifer
Ss = Specific storage of aquitard (storage per foot of thickness [1/ft])
Kh = horizontal hydraulic conductivity in feet per day (ft/day) calculated as T/b
Kv =vertical hydraulic conductivity in feet per day (ft/day)
b = Assumed aquifer thickness in feet

Table 6. Slug and Bail Test Results Summary Table; Hydrologic Field Characteristics at Twin Pines Mine; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Location	Type Test	Easting	Northing	Top of Casing Elevation (ft. amsl)	Well Depth (ft. bgs)	Screen Depth Top (ft. bgs)	Screen Depth Bottom (ft. bgs)	Screen Depth Top (ft. amsl)	Screen Depth Bottom (ft. amsl)	KGS Method		Bouwer-Rice Method
										Kh (ft/d)	Ss (1/ft)	Kh (ft/d)
PZ01S	Bail	664792.9515	213145.725	123.04	14.0	4.0	13.5	119.04	109.54	1.24E+00	3.30E-05	9.82E-01
PZ01S	Slug	664792.9515	213145.725	123.04	14.0	4.0	13.5	119.04	109.54	1.65E+00	2.60E-06	1.14E+00
PZ04	Bail	663720.3298	205447.0841	123.89	14.0	4.0	13.5	119.89	110.39	1.99E+00	4.40E-05	1.66E+00
PZ04	Slug	663720.3298	205447.0841	123.89	14.0	4.0	13.5	119.89	110.39	1.74E+00	1.67E-03	1.38E+00
PZ06	Bail	662436.2138	201256.8347	124.26	14.0	4.0	13.5	120.26	110.76	3.71E+00	2.41E-05	2.95E+00
PZ06	Slug	662436.2138	201256.8347	124.26	14.0	4.0	13.5	120.26	110.76	3.51E+00	1.26E-04	2.22E+00
PZ10	Bail	667689.3258	206292.4778	145.97	25.0	15.0	24.5	130.97	121.47	3.91E+00	1.11E-03	3.91E+00
PZ10	Slug	667689.3258	206292.4778	145.97	25.0	15.0	24.5	130.97	121.47	6.39E+00	5.49E-05	4.22E+00
PZ13	Bail	668652.4560	196413.6877	157.63	30.0	20.0	29.5	137.63	128.13	5.16E+01	1.61E-12	3.91E+01
PZ13	Slug	668652.4560	196413.6877	157.63	30.0	20.0	29.5	137.63	128.13	5.24E+01	1.61E-12	39.8 (middle time) 12.0 (late time)
PZ16S	Bail	668683.7808	189192.1062	160.42	20.0	10.0	19.5	150.42	140.92	4.10E+01	3.34E-05	3.41E+01
PZ16S	Slug	668683.7808	189192.1062	160.42	20.0	10.0	19.5	150.42	140.92	3.99E+01	5.09E-05	2.94E+01
PZ17D	Bail	670005.1448	212015.6518	161.01	45.0	35.0	44.5	126.01	116.51	4.14E+01	8.55E-13	3.44E+01
PZ17D	Slug	670005.1448	212015.6518	161.01	45.0	35.0	44.5	126.01	116.51	4.27E+01	8.55E-13	2.95E+01
PZ20D	Bail	670360.6665	205134.8784	168.46	40.0	30.0	39.5	138.46	128.96	1.84E+01	8.18E-06	1.53E+01
PZ20D	Slug	670360.6665	205134.8784	168.46	40.0	30.0	39.5	138.46	128.96	1.84E+01	2.17E-04	1.53E+01
PZ24	Bail	672562.2118	196807.9532	169.54	20.0	10.0	19.5	159.54	150.04	1.48E+01	2.19E-05	1.18E+01
PZ24	Slug	672562.2118	196807.9532	169.54	20.0	10.0	19.5	159.54	150.04	4.40E+01	3.19E-06	3.05E+01
PZ28D	Bail	672470.6111	191101.7018	173.99	30.0	20.0	29.5	153.99	144.49	2.34E+00	6.99E-05	2.04E+00
PZ29D	Bail	667975.5644	193583.6283	153.88	50.0	40	49.5	113.88	104.38	1.45E+00	1.32E-04	1.45E+00
PZ29D	Slug	667975.5644	193583.6283	153.88	50.0	40	49.5	113.88	104.38	1.25E+00	2.28E-04	1.19E+00
PZ29S	Bail	667981.0292	193588.0244	154.035	19.0	9.0	18.5	145.04	135.54	8.23E+00	7.00E-06	6.24E+00
PZ29S	Slug	667981.0292	193588.0244	154.035	19.0	9.0	18.5	145.04	135.54	5.44E+00	5.13E-04	5.70E+00
PZ30D	Bail	666484.959	189997.8257	138.02	50.0	40.0	49.5	98.02	88.52	1.09E+00	1.14E-05	9.89E-01
PZ30D	Slug	666484.959	189997.8257	138.02	50.0	40.0	49.5	98.02	88.52	1.38E+00	2.23E-05	1.21E+00
PZ30S	Bail	666491.4469	190004.5697	137.65	10.0	5.0	9.5	132.65	128.15	8.68E-01	1.07E-05	6.86E-01
PZ30S	Slug	666491.4469	190004.5697	137.65	10.0	5.0	9.5	132.65	128.15	1.09E+00	1.97E-16	1.43E+00
PZ31D	Bail	665327.2418	192381.7249	135.90	50.0	40.0	49.5	95.90	86.40	1.57E+00	5.94E-05	1.50E+00
PZ31D	Slug	665327.2418	192381.7249	135.90	50.0	40.0	49.5	95.90	86.40	1.98E+00	1.22E-04	1.98E+00
PZ31S	Bail	665331.907	192374.4898	135.92	12.0	7.0	11.5	128.92	124.42	1.42E+00	2.69E-05	1.08E+00
PZ31S	Slug	665331.907	192374.4898	135.92	12.0	7.0	11.5	128.92	124.42	1.36E+00	2.34E-06	1.03E+00
PZ33D	Bail	661249.6461	192704.3174	123.91	50.5	41.0	50.5	82.91	73.41	2.77E+00	8.22E-06	1.75E+00
PZ33D	Slug	661249.6461	192704.3174	123.91	50.5	41.0	50.5	82.91	73.41	2.23E+00	2.55E-05	1.48E+00
PZ33S	Bail	661258.6777	192703.2169	123.73	13.0	7.0	11.5	116.73	112.23	2.66E+00	5.85E-06	1.93E+00
PZ33S	Slug	661258.6777	192703.2169	123.73	13.0	7.0	11.5	116.73	112.23	2.63E+00	7.72E-06	1.99E+00
PZ55D	Bail	663504.9654	187429.6642	174.92	50.0	40.0	49.5	134.92	125.42	2.03E+01	1.16E-05	1.85E+01
PZ55D	Slug	663504.9654	187429.6642	174.92	50.0	40.0	49.5	134.92	125.42	2.20E+01	6.23E-05	2.10E+01
PZ55S	Bail	671858.651	188474.3774	174.83	20.0	14.0	19.5	160.83	155.33	9.46E-01	1.40E-06	7.18E-01
PZ55S	Slug	671858.651	188474.3774	174.83	20.0	14.0	19.5	160.83	155.33	2.40E-01	1.63E-05	1.99E-01
PZ57D	Bail	675314.5224	192314.0733	165.89	50.0	39.0	48.5	126.89	117.39	5.47E+01	3.79E-20	6.58E+01
PZ57D	Slug	675314.5224	192314.0733	165.89	50.0	39.0	48.5	126.89	117.39	3.59E+01	2.03E-04	7.51E+01
PZ57S	Bail	675311.1832	192310.6915	165.68	14.0	9.0	13.5	156.68	152.18	6.77E+00	6.37E-05	5.38E+00
PZ57S	Slug	675311.1832	192310.6915	165.68	14.0	9.0	13.5	156.68	152.18	7.26E+00	5.75E-05	5.78E+00
PZ58D	Bail	676850.4859	196491.6367	139.98	50.0	40.0	49.5	99.98	90.48	5.10E+00	2.24E-04	5.10E+00
PZ58D	Slug	676850.4859	196491.6367	139.98	50.0	40.0	49.5	99.98	90.48	3.55E+00	2.18E-03	5.38E+00
PZ58S	Bail	676849.7667	196495.5787	140.02	15.0	10.0	14.5	130.02	125.52	2.66E+01	7.87E-05	2.11E+01
PZ58S	Slug	676849.7667	196495.5787	140.02	15.0	10.0	14.5	130.02	125.52	2.42E+01	8.67E-05	1.92E+01

Bouwer-Rice = Unconfined Bouwer-Rice solution method in Aqtesolv™

ft/d = feet per day

Kh = hydraulic conductivity

KGS = Unconfined KGS solution method in Aqtesolv™

Ss = specific storage

ft bgs = feet below ground surface

ft amsl = feet above mean sea level

APPENDIX A

Attached Documents:
Boring Logs

APPENDIX A
BORING LOGS

PUMPING TEST AREA A

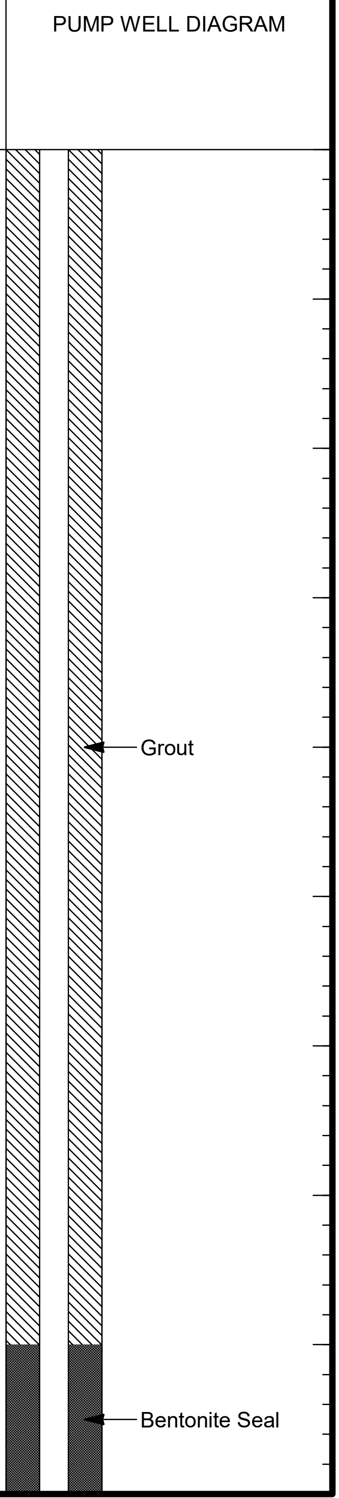
TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF PUMP WELL PW A & PUMP WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	A. Patton
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	12/20/2018
DRILLING COMPANY	Patridge Well Co.	**CASING DIA./TYPE**	6" PVC
DRILLER	Randy Baker	**SCREEN SLOT/TYPE**	0.020-inch
DRILLING METHOD	Rotary	**FILTER PACK TYPE**	16/30 Colorado silica
		TOP OF CASING	174.74 Ft. AMSL
REMARKS		**GROUND ELEVATION**	171.56 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		SP				SAND: light brown to tan; med; subround	
10		SM				SAND, silty: black (quartz); fine; argillaceous; hardpan	
		SP				SAND: light brown, tan, yellowish grey; med; clean	
20		SP				SAND: dark brown, tan, yellowish grey; med	
40						SAND: darker brown (5YR 3/2); fine; well sorted; subround	



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE SAINT GEORGE, GEORGIA		**LOG OF PUMP WELL PW A & PUMP WELL CONSTRUCTION**

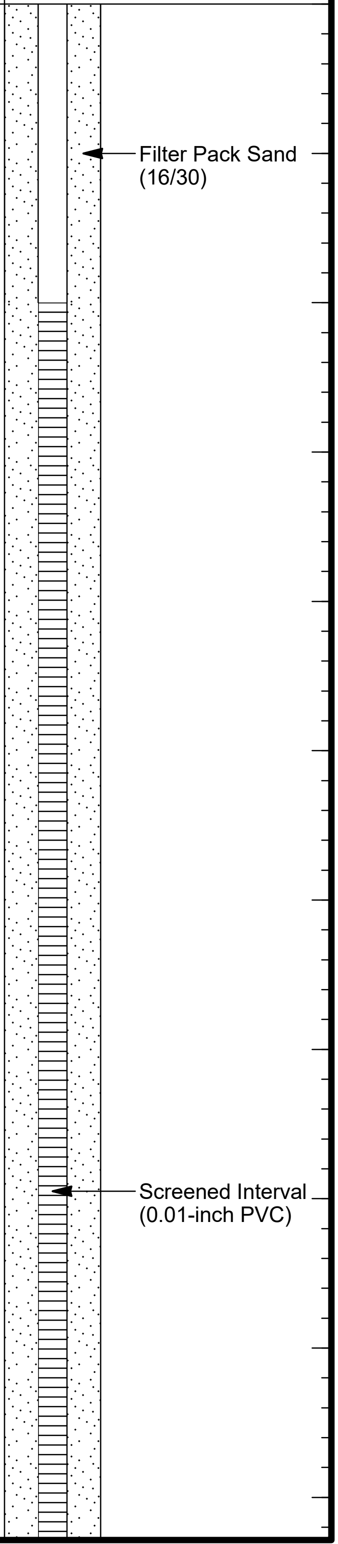
PROJECT NUMBER 000180200804.00 **PROFESSIONAL** A. Patton

LOCATION Saint George, Georgia **DATE(S) DRILLED** 12/20/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
50, 55		SP					
60, 65, 70		SP				SAND: darker brown (5YR 3/2); fine; well sorted; subround	
		CL				CLAY, sandy: dark yellowish brown (10YR 4/2); fine to med; saturated	
75, 80, 85		SP				SAND: well sorted	
90		CH				CLAY: dark green; fat	
95						CLAY, sandy: dark greenish grey; fat	

PUMP WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF PUMP WELL PW A & PUMP WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

PROFESSIONAL A. Patton

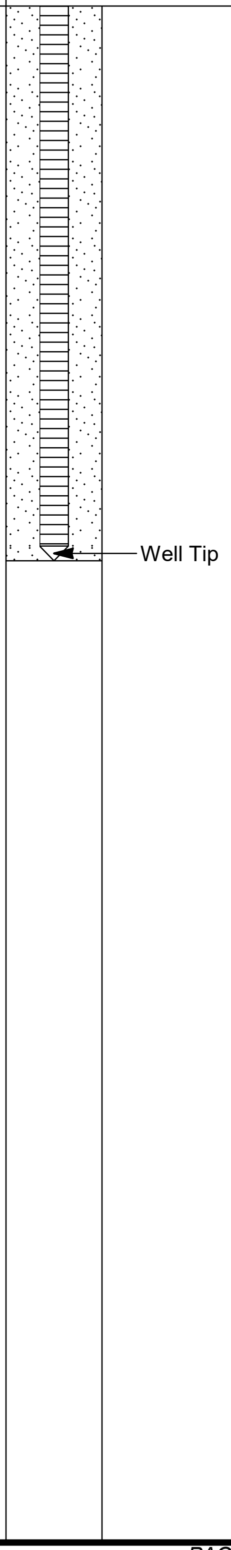
LOCATION Saint George, Georgia

DATE(S) DRILLED 12/20/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
100	▨						
105	▨	CL					
110	▨						
115						BORING TERMINATED AT 116 FEET.	

PUMP WELL DIAGRAM



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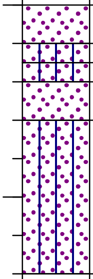
TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

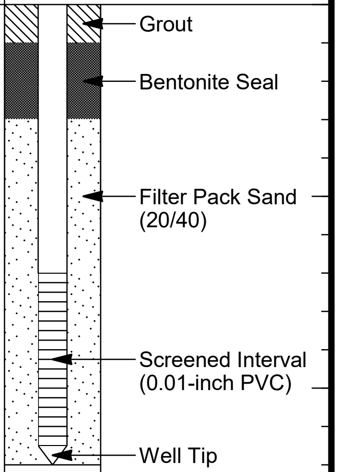
LOG OF OBSV. WELL OWA1BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	12/11/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.16 Ft. AMSL
REMARKS	Same as OWA-1S for 0-12	**GROUND ELEVATION**	171.78 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE			LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			INTERVAL (feet)	% RECOVERY	PID (ppm)		
			0-10	60		No recovery	
5		SP				SAND: (quartz); fine (20%); med (40%); coarse (40%); well sorted; subround; unconsolidated; dry; organic (wood and roots)	
		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; organic (fibrous) material	
		SM				SAND, silty: dark yellowish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
		SP				SAND: light brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist	
10		SM				SAND, silty: dark brown (quartz); fine (60%); med (25%); coarse (10%); silt (<5%); well sorted; subround; semi-consolidated; FBG (<1%)	

BORING TERMINATED AT 12 FEET.

OBSV. WELL DIAGRAM



This well log shall not be separated from the corresponding Instrument of Service; no third party may rely upon this well logor the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA1D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

DRILLING COMPANY Betts

DRILLER C. Pendarvis

DRILLING METHOD Sonic

REMARKS

PROFESSIONAL T. Hall

DATE(S) DRILLED 11/9/2018

CASING DIA./TYPE 2" PVC

SCREEN SLOT/TYPE 0.010-in. slotted PVC

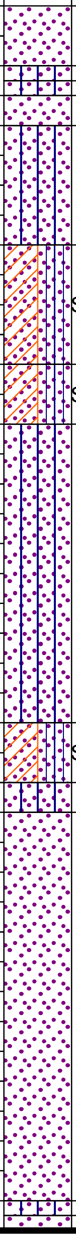
FILTER PACK TYPE

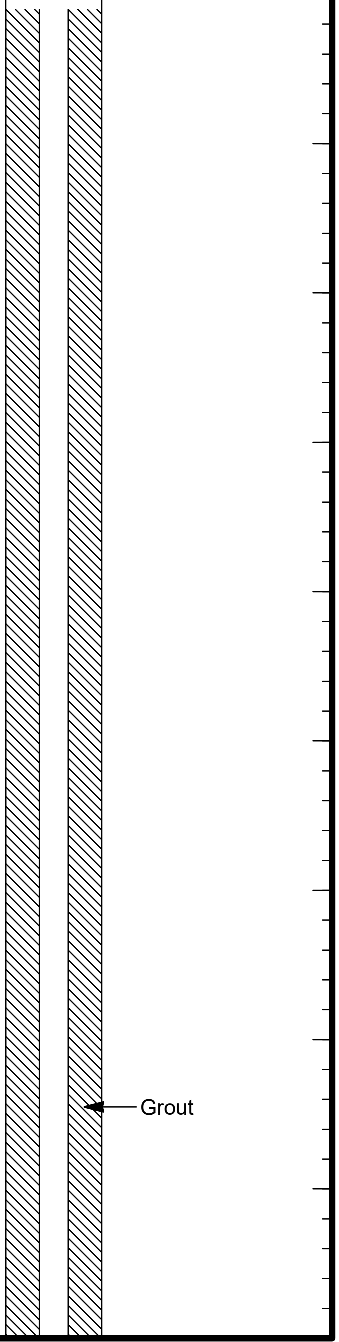
TOP OF CASING 172.23 Ft. AMSL

GROUND ELEVATION 171.97 Ft. AMSL

DEPTH TO WATER

WATER ELEVATION





DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE	OBSV. WELL DIAGRAM
			0-10	60		No recovery		
5		SP				SAND: grey (quartz); fine (20%); med (40%); coarse (40%); well sorted; subround; unconsolidated; organics (wood roots)		
		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; organic material (wood)		
		SM				SAND, silty: dark yellowish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)		
		SP				SAND: light brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist		
10		SM	10-20	100				
15		SC-SM				SAND, silty: dark brown; fine (60%); med (25%); coarse (10%); silt (<5%); well sorted; subround; semi-consolidated; moist; FBG (<1%) SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay <5%, well sorted, subround, well consolidated, moist		
		SC-SM				SAND, silty, clayey: dark brown (quartz); fine (15%); med (40%); coarse (40%); silt (<5%); well sorted; subround; consolidated; moist		
20 25		SM	20-30	90		SAND, silty: brown (quartz); fine (40%); med (30%); coarse (25%); silt (<5%); well sorted; subround; unconsolidated; moist		
		SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated; moist		
30		SM	30-40	100		SAND, silty: dark brown; fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist		
35 40		SP	40-50	90		SAND: dark yellowish brown (quartz); fine (30%); med (50%); coarse (20%); well sorted; subround; unconsolidated; moist; FBG (<1%)		
		SM				SAND, silty: black (quartz); fine (75%); med (20%); silt (<5%);		

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TTL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA1D & OBSV. WELL CONSTRUCTION

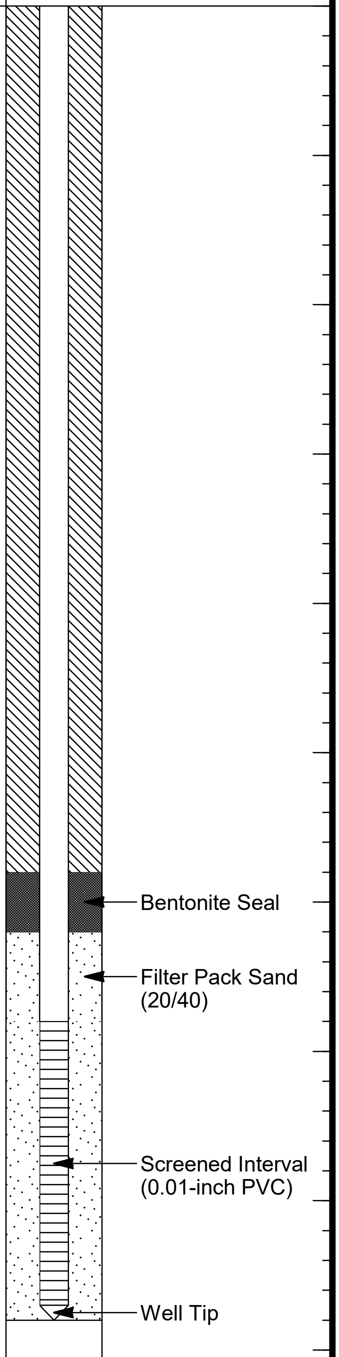
PROJECT NUMBER 000180200804.00
PROFESSIONAL T. Hall
LOCATION Saint George, Georgia
DATE(S) DRILLED 11/9/2018

Continued from Previous Page

DEPTH (feet)	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
	SP				well sorted; subround; well consolidated; moist SAND: (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; increase in fine black grains (>1%)	
50		50-60	80			
55						
60		60-70	80			
65	SC-SM				SAND, silty, clayey: dark brown; fine (80%); med (15%); silt (<5%); well sorted; subround; semi-consolidated; moist	
	SP				SAND: brown (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
	CL				CLAY, sandy: dark brown; fine	
70	SC-SM	70-80	70		SAND, silty, clayey: grayish brown (quartz); fine (95%); silt/clay (<5%); well sorted; subround; semi-consolidated; FBG (<1%)	
75						
	CL				CLAY, sandy: dark grey; fine	
80						
85						
	CH				CLAY: dark grey; fat	
	SP				SAND: dark grey (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
	CH				CLAY: dark grey; fat	
90						

BORING TERMINATED AT 90 FEET.

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

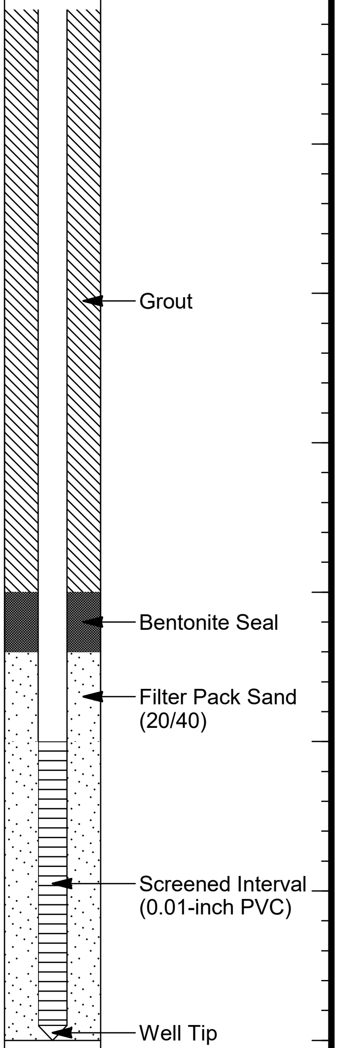
LOG OF OBSV. WELL OWA1S & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
DRILLING COMPANY Betts
DRILLER C. Pendarvis
DRILLING METHOD Sonic
REMARKS

PROFESSIONAL T. Hall
DATE(S) DRILLED 11/9/2018
CASING DIA./TYPE 2" PVC
SCREEN SLOT/TYPE 0.010-in. slotted PVC
FILTER PACK TYPE
TOP OF CASING 172.12 Ft. AMSL
GROUND ELEVATION 171.93 Ft. AMSL
DEPTH TO WATER
WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
						No recovery	
5		SP				SAND: (quartz); fine (20%); med (40%); coarse (40%); well sorted; subround; unconsolidated; dry; organic (wood and roots)	
		SM				SAND: very dark brown (quartz); silty; fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; organic (fibrous) material	
		SM				SAND: dark yellowish brown (quartz); silty; fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
		SP				SAND: light brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist	
10		SM				SAND: dark brown (quartz); silty; fine (60%); med (25%); coarse (10%); silt (<5%); well sorted; subround; semi-consolidated; FBG (<1%)	
15		SC-SM				SAND: black (quartz); silty; clayey; fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; moist	
		SC-SM				SAND: black (quartz); silty; clayey; fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; semi-consolidated; moist; strings dark brown	
20 25		SM				SAND: brown (quartz); silty; fine (40%); med (30%); coarse (25%); silt (<5%); well sorted; subround; unconsolidated	
30		SC-SM				SAND: black (quartz); silty; clayey; fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated; moist	
		SM				SAND: dark brown (quartz); silty; fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist	
		SP				SAND: dark yellowish brown (quartz); fine (30%); med (50%); coarse (20%); well sorted; subround; unconsolidated; moist	
35						BORING TERMINATED AT 35 FEET.	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA2BS & OBSV. WELL CONSTRUCTION

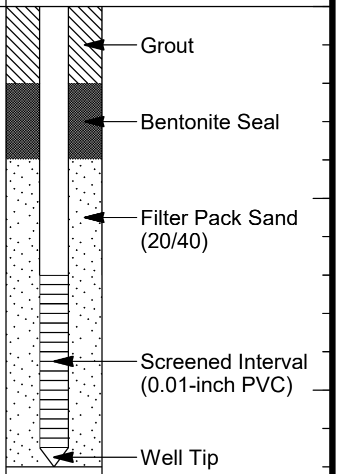
PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
DRILLING COMPANY Betts
DRILLER C. Pendarvis
DRILLING METHOD Sonic

REMARKS

PROFESSIONAL T. Hall
DATE(S) DRILLED 12/12/2018
CASING DIA./TYPE 2" PVC
SCREEN SLOT/TYPE 0.010-in. slotted PVC
FILTER PACK TYPE
TOP OF CASING 172.27 Ft. AMSL
GROUND ELEVATION 172.04 Ft. AMSL
DEPTH TO WATER
WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE			LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			INTERVAL (feet)	% RECOVERY	PID (ppm)		
			0-10	60		No Recovery	
5		SP				SAND: grey (quartz); fine (50%); med (40%); coarse (10%); well sorted; subround; unconsolidated; dry; FBG (<1%); organic material (roots)	
10		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist	
						BORING TERMINATED AT 12 FEET.	

OBSV. WELL DIAGRAM



This well log shall not be separated from the corresponding Instrument of Service; no third party may rely upon this well logor the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

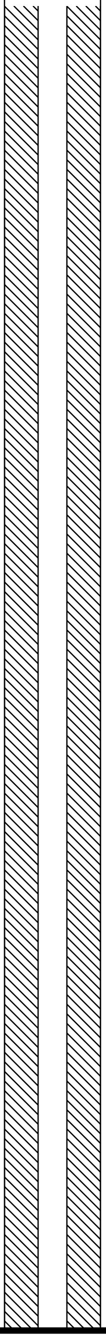
LOG OF OBSV. WELL OWA2D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
DRILLING COMPANY Betts
DRILLER C. Pendarvis
DRILLING METHOD Sonic
REMARKS

PROFESSIONAL T. Hall
DATE(S) DRILLED 11/13/2018
CASING DIA./TYPE 2" PVC
SCREEN SLOT/TYPE 0.010-in. slotted PVC
FILTER PACK TYPE
TOP OF CASING 172.34 Ft. AMSL
GROUND ELEVATION 172.10 Ft. AMSL
DEPTH TO WATER
WATER ELEVATION

DEPTH (feet)	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		0-10	60		No Recovery	
5	SP				SAND grey (quartz), fine 50%, med 40%, coarse 10%, well sorted, subround, unconsolidated, dry, FBG (<1%), organics (roots)	
10	SM	10-20	80		SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist	
15	SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; moist	
20	SM	20-30	80		SAND, silty: dark brown (quartz); fine (60%); med (25%); coarse (10%); silt (<5%); well sorted; subround; unconsolidated; moist	
	SP				SAND: yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
25	SP				SAND: (quartz); fine (60%); med (30%); coarse (10%); well sorted; subround; unconsolidated; moist	
	SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; moist	
30	SP	30-40	100		SAND: dark yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; FBG (<1%)	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

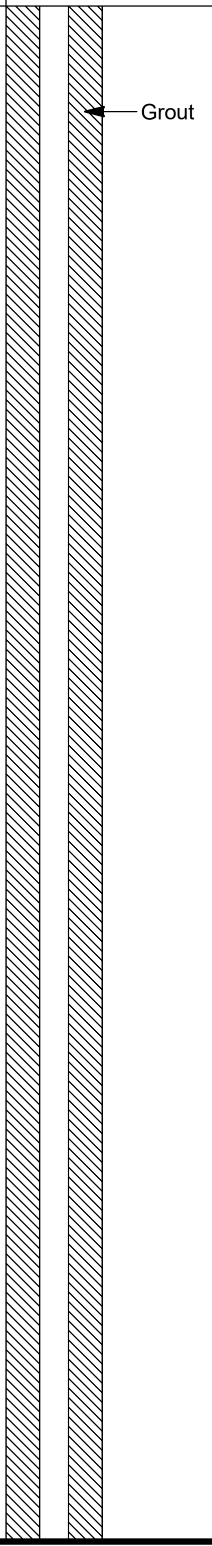
LOG OF OBSV. WELL OWA2D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
PROFESSIONAL T. Hall
LOCATION Saint George, Georgia
DATE(S) DRILLED 11/13/2018

Continued from Previous Page

DEPTH (feet)	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
40	SP	40-50	90		SAND: yellowish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
45	SP				SAND: yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; FBG (<1%)	
	SC-SM				SAND, silty, clayey: very dark brown (quartz); fine (80%); med (15%); silt/clay (<5%); well sorted; subround; semi-consolidated; moist	
	SP				SAND: yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; FBG (<1%)	
50	SC-SM				SAND, silty, clayey: very dark brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; semi-consolidated; moist	
55	SM	50-60	70		SAND, silty: (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
	SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated	
60	SC-SM	60-70	80		SAND, silty, clayey: dark brown (quartz); fine (95%); silt/clay (>5%); well sorted; subround; semi-consolidated	
	SP				SAND: grayish brown (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; FBG (<1%)	
	SC-SM				SAND, silty, clayey: dark grayish brown (quartz); fine (95%); silt/clay (<5%); well sorted; subround; semi-consolidated; moist	
65	SP				SAND: light grey (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
70	SP				SAND: grey (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
	SC-SM				SAND, silty, clayey: light grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; FBG (<1%); organic material (wood fragments)	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA2D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

PROFESSIONAL T. Hall

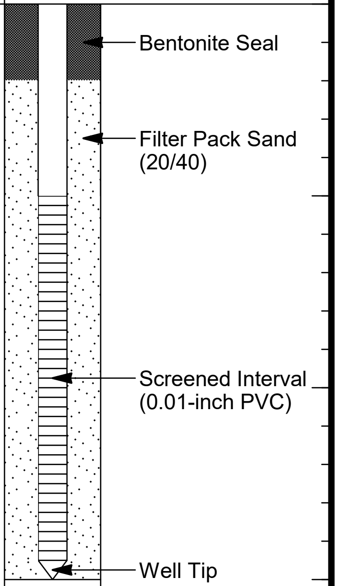
DATE(S) DRILLED 11/13/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		SC-SM				SAND, silty, clayey: dark grayish brown (quartz); fine (60%); med (35%); silt/clay (<5%); well sorted; subround; semi-consolidated; moist; FBG (<1%)	
80		SP				SAND: white (quartz); fine (50%); med (50%); FBG (<1%)	
		SC	80-90	70		SAND, clayey: dark grey (quartz); fine (50%); med (25%); coarse (20%); clay (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%); fat clay nodules	
85		CH				CLAY: dark grey; fat	
90		SP				SAND: dark grey (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	

BORING TERMINATED AT 90 FEET.

OBSV. WELL DIAGRAM



TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

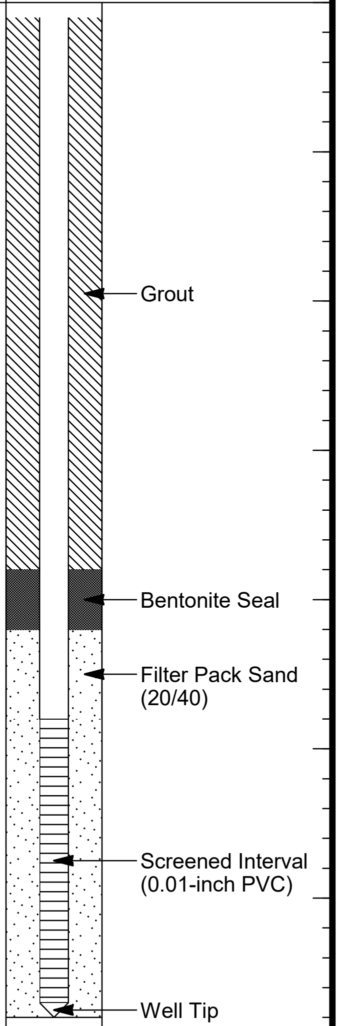
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA2S & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	11/14/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.01 Ft. AMSL
REMARKS		**GROUND ELEVATION**	171.91 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			0-10	70		No Recovery	
5		SP				SAND: grey (quartz); fine (50%); med (40%); coarse (10%); well sorted; subround; unconsolidated; dry; FBG (<1%); organic material (roots)	
10		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist	
15		SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; moist	
20		SM				SAND, silty: dark brown (quartz); fine (60%); med (25%); coarse (10%); silt (<5%); well sorted; subround; unconsolidated; moist	
		SP				SAND: yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
25		SP				SAND: (quartz); fine (60%); med (30%); coarse (10%); well sorted: subround: unconsolidated; moist; FBG (<1%)	
		SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; well consolidated; moist	
30		SP				SAND: dark yellowish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; FBG (<1%)	
35						BORING TERMINATED AT 35 FEET.	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

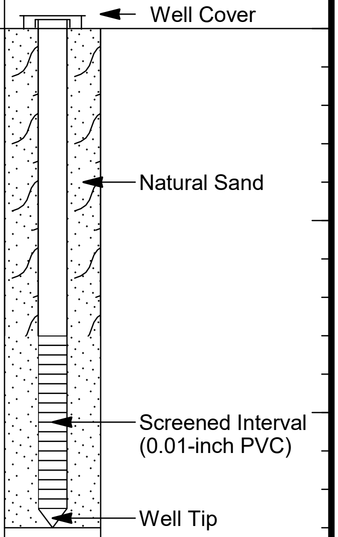
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA3BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	A. Wiggins
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	1/30/2019
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2 " PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	Natural
		TOP OF CASING	172.35 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.11 Ft. AMSL
		DEPTH TO WATER	1.03 Ft. BMP
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		SP	0-5	100		SAND: black (10YR 2/1); poorly graded; med; saturated	
5		SP	5-10	100		SAND: light reddish grey (2.5YR 7/1); med; saturated; organics (5.5-6)	
		SP				SAND: weak red (2.5YR 5/2); poorly graded; med; saturated	
		SP				SAND: very dark brown (2.5YR 2.5/2); poorly graded; med; saturated	
10		SP	10-15	100		SAND: very dark brown (2.5YR 2.5/2); poorly graded; med; saturated	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



M:\PROJECTS\2018\000180200804.00 - TWIN PINES MINERALS PERMITTING SERVICES\804-LOGS RESTORED FROM 8-7804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ 7/2/19 Report:ENV LOG - WELL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA4BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

DRILLING COMPANY Betts

DRILLER C. Pendarvis

DRILLING METHOD Sonic

REMARKS

PROFESSIONAL A. Wiggins

DATE(S) DRILLED 1/30/2019

CASING DIA./TYPE 2" PVC

SCREEN SLOT/TYPE 0.010-inch.

FILTER PACK TYPE Natural

TOP OF CASING 172.44 Ft. AMSL

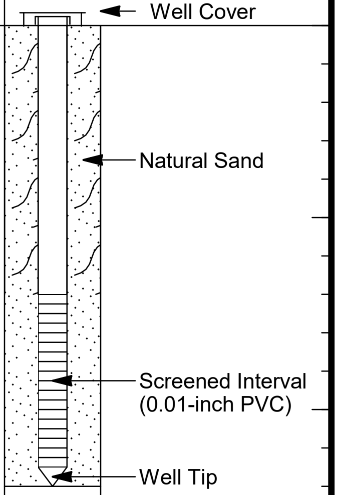
GROUND ELEVATION 172.16 Ft. AMSL

DEPTH TO WATER 1.25 Ft. BMP

WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		SP	0-5	100		SAND: black (10R 2/1); poorly graded; med; moist	
5		SP	5-10	100		SAND: reddish grey (2.5YR 7/1); poorly graded; med; moist	
		SP				SAND: weak red (2.5YR 5/2); poorly graded; med; moist; organics (5.5-6 feet)	
		SP				SAND: very dark brown (2.5YR 2.5/2); poorly graded; med; moist	
10		SP	10-15	100		SAND: black (10R 2/1); poorly graded; med; saturated	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



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This well log shall not be separated from the corresponding Instrument of Service; no third party may rely upon this well logor the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

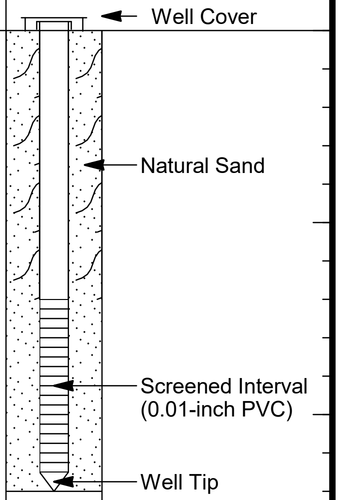
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWA5BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	A. Wiggins
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	1/30/2019
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in.
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	Natural
		TOP OF CASING	172.28 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.09 Ft. AMSL
		DEPTH TO WATER	0.7 Ft. BMP
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
	▨	SP	0-5	100		SAND: black (5YR 2.5/1); poorly graded; med	
5	▨	SP	5-10	100		SAND: grey (5yr 6/1); poorly graded; med; organics	
	▨	SP				SAND: dark yellowish brown (10YR 3/6) and brown (10YR 4/3); poorly graded	
	▨	SP				SAND: very pale brown (10YR 7/3) and greyish brown (10YR 5/2); poorly graded	
10	▨	SP	10-15	100		SAND: black (5YR 2.5/1); poorly graded; med; saturated	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



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PUMPING TEST AREA B

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

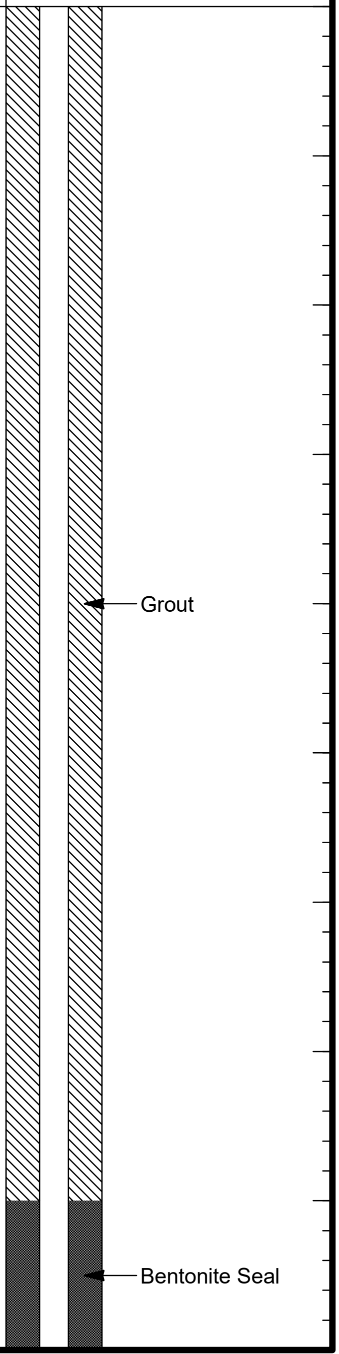
SAINT GEORGE, GEORGIA

LOG OF PUMP WEL PW B & PUMP WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	A. Patton
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	12/10/2018 - 12/14/2018
DRILLING COMPANY	Patridge Well Co.	**CASING DIA./TYPE**	6" PVC
DRILLER	Randy Baker	**SCREEN SLOT/TYPE**	0.020-inch
DRILLING METHOD	Rotary	**FILTER PACK TYPE**	16/30 Colorado silica
		TOP OF CASING	174.41 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.46 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
0–10		SP				SAND: light brown to black	
10–20		SM				SAND, sandy: black; med to fine; consolidated; hardpan at 15'	
20–40		SP				SAND: very dark brown to almost black; few organics	
40–						SAND, sandy: light brown to tan (yellowish brown); fine to med; well sorted; subround	

PUMP WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

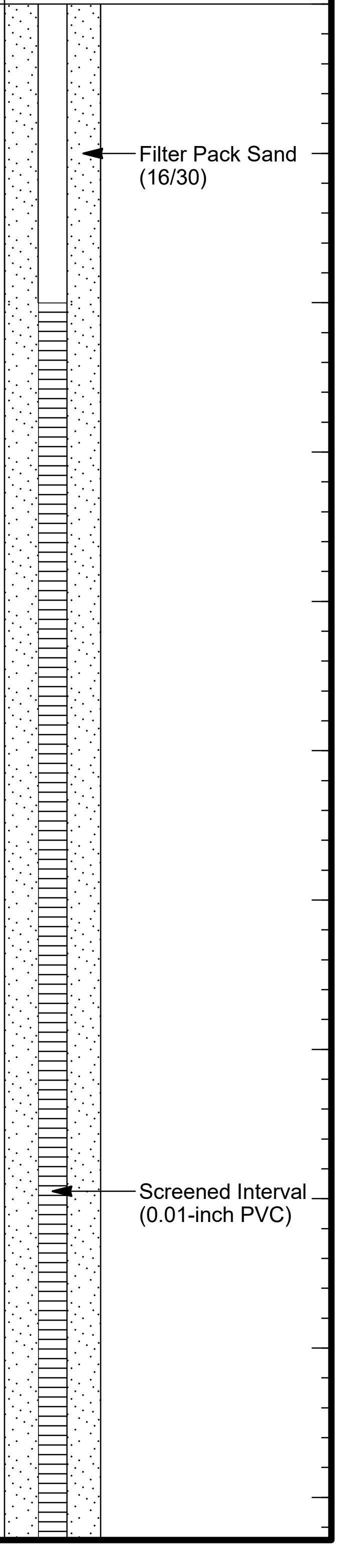
LOG OF PUMP WEL
PW B
& PUMP WELL
CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
PROFESSIONAL A. Patton
DATE(S) DRILLED 12/10/2018 - 12/14/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
50 55		SM					
60 65 70 75		SC				SAND, clayey: medium bluish grey to medium dark grey; fine; well sorted; argillaceous	
80 85 90 95		SC				SAND, clayey: black; no reaction	

PUMP WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

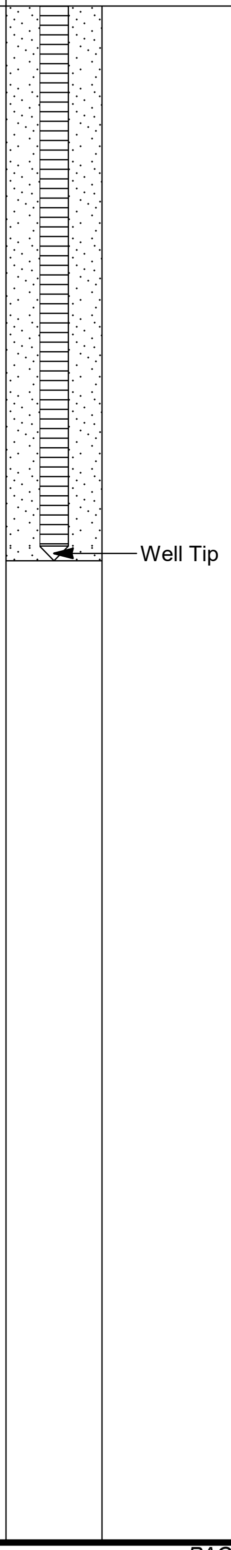
**LOG OF PUMP WEL
PW B
& PUMP WELL
CONSTRUCTION**

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
PROFESSIONAL A. Patton
DATE(S) DRILLED 12/10/2018 - 12/14/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
100–115		SP				SAND: black	
115						BORING TERMINATED AT 115 FEET.	

PUMP WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

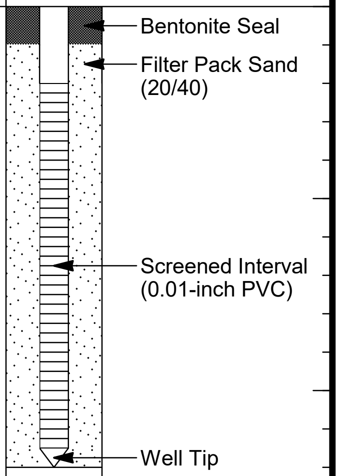
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB1BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	12/7/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.38 Ft. AMSL
REMARKS	Same as OWB-1S and OWB-1D for 0-12	**GROUND ELEVATION**	172.17 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			0-10	80		No Recovery	
		SM				SAND, silty: dark grey (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist; organics (wood/roots)	
5 10		SM				SAND, silty: dark grayish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist	
						BORING TERMINATED AT 12 FEET.	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

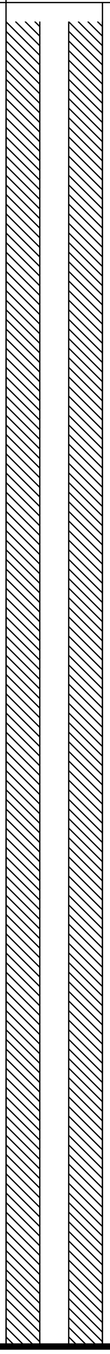
LOG OF OBSV. WELL OWB1D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	11/27/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Golden	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.49 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.36 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

7/2/19 Report:ENV LOG - WELL M:\PROJECTS\2018\000180200804.00 - TWIN PINES MINERALS PERMITTING SERVICES\804-LOGS RESTORED FROM 8-7804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			0-10	80		No Recovery	
		SM				SAND, silty: dark grey (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist; organic material (wood/roots/shoots)	
5		SM				SAND, silty: dark grayish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
10			10-20	80			
15		SM				SAND, silty: black (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated; moist	
		SM				SAND, silty: brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; semi-consolidated; moist; FBG (<1%)	
20			20-30	80			
		SP				SAND: light grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
25		SM				SAND, silty: dark brown (quartz); fine (70%); med (20%); coarse (5%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
30			30-40	70			
		SC-SM				SAND, silty, clayey: black (quartz); fine (95%); silt/clay (<5%);	

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

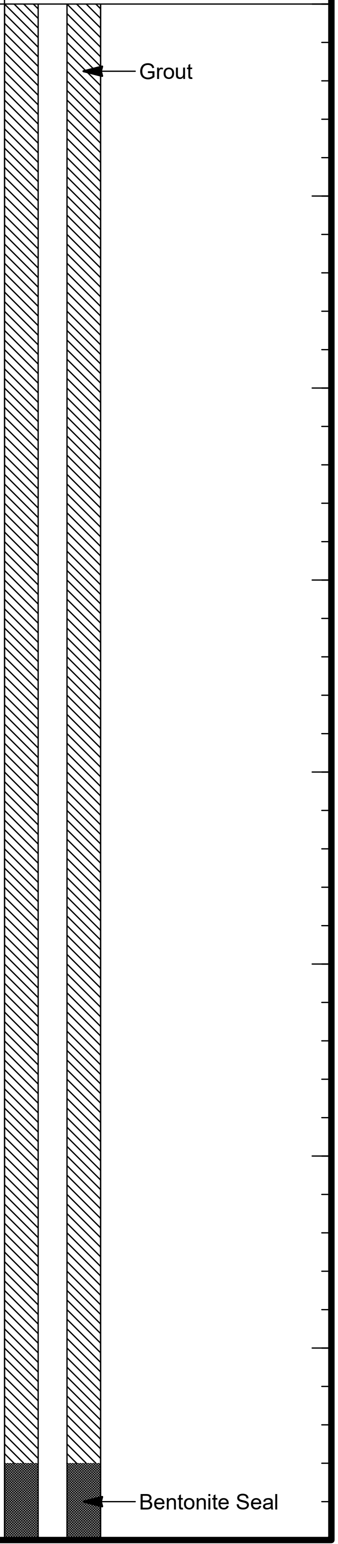
LOG OF OBSV. WELL OWB1D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
PROFESSIONAL T. Hall
DATE(S) DRILLED 11/27/2018

Continued from Previous Page

DEPTH (feet)	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
					well sorted; subround; well consolidated; moist	
	SM				SAND, silty: dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; FBG (<1%)	
40		40-50	80			
45						
50	SP	50-60	80		SAND: grayish brown (quartz); fine (50%); med (40%); coarse (10%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
55						
	SP				SAND: dark grayish brown (quartz); fine (50%); med (25%); coarse (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
60		60-70	80			
	CL				CLAY, sandy: grayish brown; fine; FBG (<1%)	
65						
	SC				SAND, clayey: light brownish grey (quartz); fine (95%); clay (5%); well sorted; subround; moist; FBG (<1%)	
70		70-80	60			

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB1D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

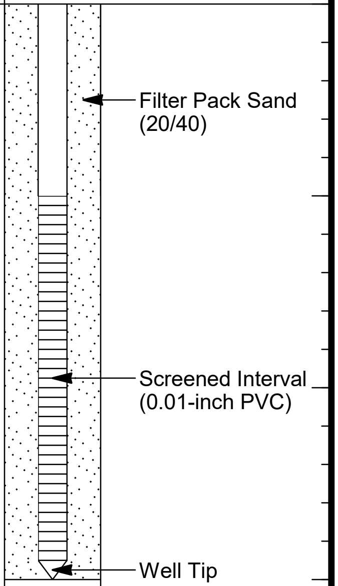
PROFESSIONAL T. Hall

DATE(S) DRILLED 11/27/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE			LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			INTERVAL (feet)	% RECOVERY	PID (ppm)		
		SP				SAND: fine (60%) med (30%); coarse (10%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
80			80-90	80			
		SP				SAND: fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
85		SC-SM				SAND, silty, clayey: (quartz); fine (75%); med (20%); silty/clay (<5%); well sorted; subround; moist; FBG (<1%)	
		SP				SAND: (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
90						BORING TERMINATED AT 90 FEET.	

OBSV. WELL DIAGRAM



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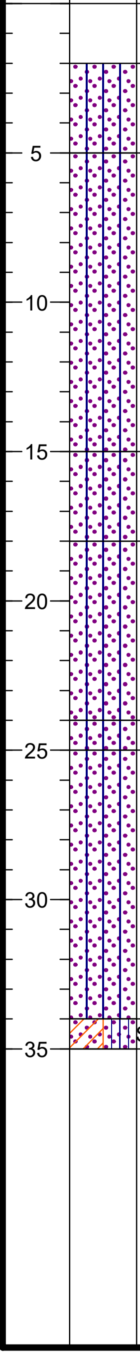
TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB1S & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
DRILLING COMPANY Betts
DRILLER C. Golden
DRILLING METHOD Sonic
REMARKS

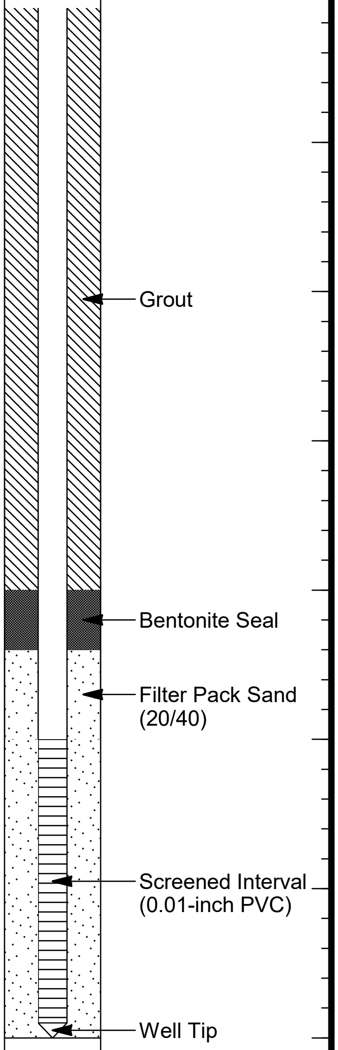
PROFESSIONAL T. Hall
DATE(S) DRILLED 11/27/2018
CASING DIA./TYPE 2" PVC
SCREEN SLOT/TYPE 0.010-in. slotted PVC
FILTER PACK TYPE
TOP OF CASING 172.43 Ft. AMSL
GROUND ELEVATION 172.34 Ft. AMSL
DEPTH TO WATER
WATER ELEVATION



U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
	0-10	80		No Recovery	
SM				SAND, silty: dark grey (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist; organics (wood/roots)	
SM				SAND, silty: dark grayish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist	
SM				SAND, silty: black (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated; moist	
SM				SAND, silty: brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; semi-consolidated; moist; FBG (<1%)	
SM				SAND, silty: light grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<!%)	
SM				SAND, silty: dark brown (quartz); fine (70%); med (20%); coarse (5%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
SC-SM				SAND, silty, clayey: black (quartz); fine (95%); silt/clay (<5%); well sorted; subround; well consolidated; moist	

BORING TERMINATED AT 35 FEET.

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB2BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

DRILLING COMPANY Betts

DRILLER C. Pendarvis

DRILLING METHOD Sonic

REMARKS Same as OWB-2S and OWB-2D for 0-12 interval

PROFESSIONAL T. Hall

DATE(S) DRILLED 12/7/2018

CASING DIA./TYPE 2" PVC

SCREEN SLOT/TYPE 0.010-in. slotted PVC

FILTER PACK TYPE

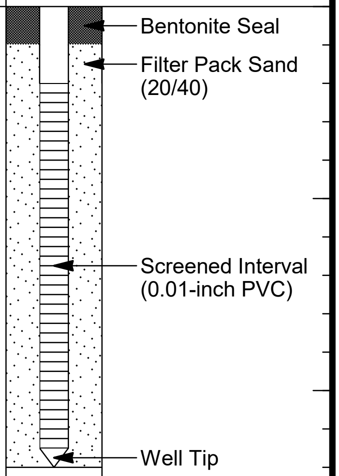
TOP OF CASING 172.47 Ft. AMSL

GROUND ELEVATION 172.59 Ft. AMSL

DEPTH TO WATER

WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE			LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE	OBSV. WELL DIAGRAM
			INTERVAL (feet)	% RECOVERY	PID (ppm)			
			0-10	80		No Recovery		
		SM				SAND, silty: dark yellowish brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist		
5		SM				SAND, silty: dark grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; semi-consolidated; moist		
10		SM	10-20	80		SAND, silty: dark brown (quartz); fine (50%); med (40%); silt (<5%); well sorted; subround; unconsolidated; moist		
						BORING TERMINATED AT 12 FEET.		



TTL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

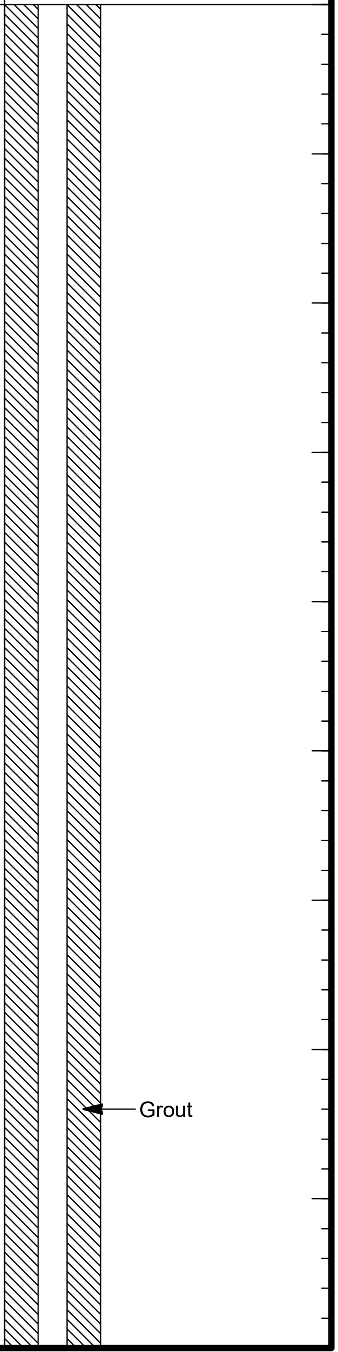
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB2D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	11/28/2018 - 11/29/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.76 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.75 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	 % RECOVERY	 PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			0-10	80		No Recovery	
		SM				SAND, silty: dark yellowish brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist	
5		SM				SAND, silty: dark grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; semi-consolidated; moist	
10		SM	10-20	80		SAND, silty: dark brown (quartz); fine (50%); med (40%); silt (<5%); well sorted; subround; unconsolidated; moist	
15		SC-SM				SAND: silty; clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; semi-consolidated	
20 25		SP	20-30	80		SAND: grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
30		SM	30-40	80		SAND, silty: (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
		SM				SAND, silty: very dark brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; well consolidated; moist	
35 40		SM	40-50	80		SAND, silty: (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
						SAND: dark yellowish brown (quartz); fine (60%); med (30%); coarse (10%); well sorted subround; moist; FBG (<1%)	

OBSV. WELL DIAGRAM



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TTL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB2D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

PROFESSIONAL T. Hall

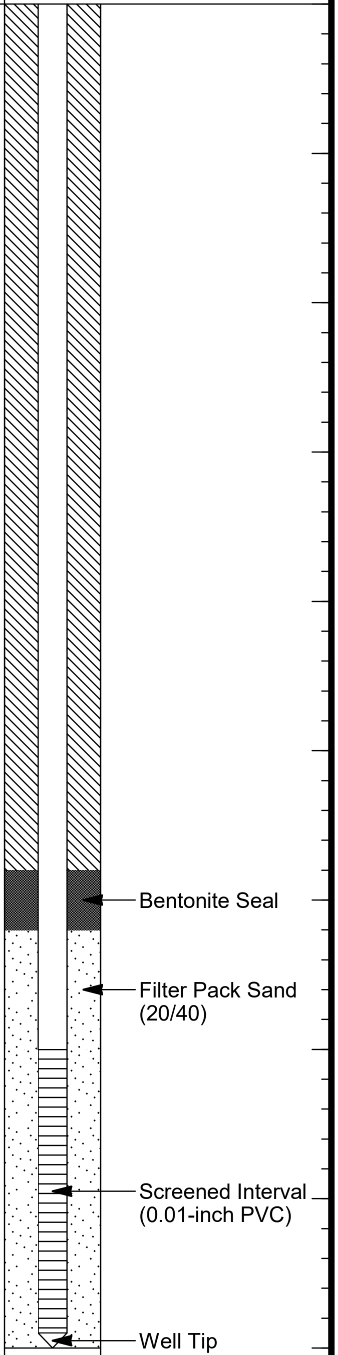
DATE(S) DRILLED 11/28/2018 - 11/29/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
50 55 60		SP	50-60	80			
		SM	60-70	80		SAND, silty: grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; FBG (<1%)	
65		CL				CLAY: dark grayish brown; sandy; fine	
70		SM				SAND, silty: grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; FBG (<1%)	
75			70-80	0		No Recovery	
80		SP	80-90	70		SAND: (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated FBG (<1%)	
85		SC-SM				SAND, silty, clayey: (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; moist; FBG (<1%)	
90		SP				SAND: light grayish brown (quartz); find (75%); med (25%); well sorted; subround; unconsolidated; moist	

BORING TERMINATED AT 90 FEET.

OBSV. WELL DIAGRAM



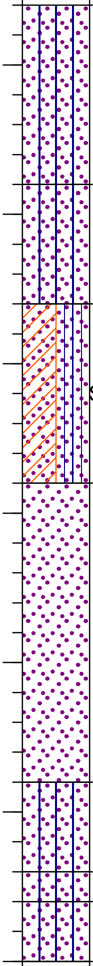
This well log shall not be separated from the corresponding Instrument of Service; no third party may rely upon this well logor the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB2S & OBSV. WELL CONSTRUCTION

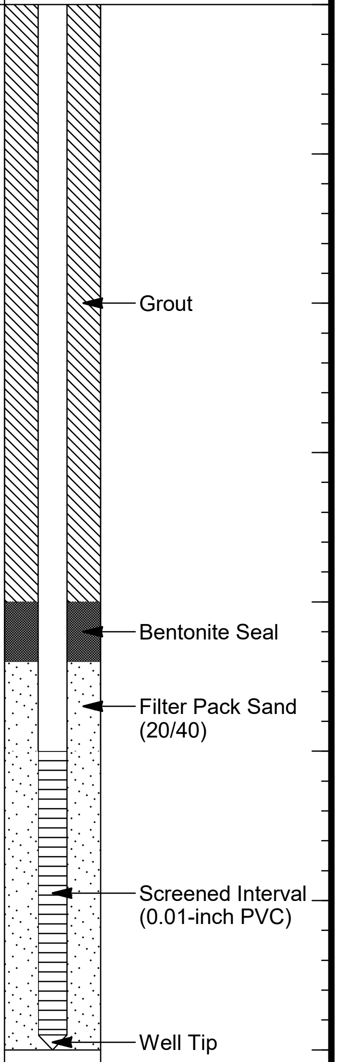
PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	11/30/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	172.79 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.86 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	



DEPTH (feet)	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
		0-10	70		No Recovery	
5	SM				SAND, silty: dark grayish brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; semi-consolidated; moist	
10	SM				SAND, silty: dark brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist	
15	SC-SM				SAND, silty, clayey: black (quartz); fine (75%); med (20%); silt/clay (<5%); well sorted; subround; semi-consolidated; moist	
20 25	SP				SAND: grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
30	SM				SAND, silty: brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
	SM				SAND, silty: very dark brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; well consolidated	
35	SM				SAND, silty: brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	

BORING TERMINATED AT 35 FEET.

OBSV. WELL DIAGRAM



M:\PROJECTS\2018\000180200804.00 - TWIN PINES MINERALS PERMITTING SERVICES\804-LOGS RESTORED FROM 8-7\804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ 7/2/19 Report:ENV LOG - WELL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

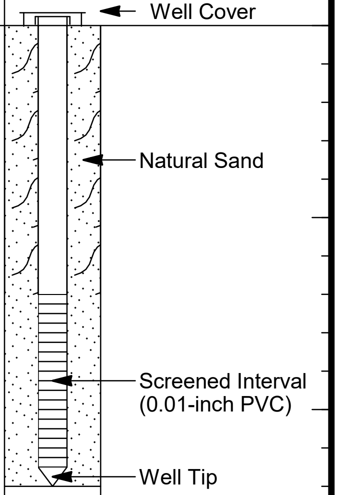
LOG OF OBSV. WELL OWB3BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
DRILLING COMPANY Betts
DRILLER C. Pendarcis
DRILLING METHOD Sonic
REMARKS

PROFESSIONAL A. Wiggins
DATE(S) DRILLED 1/30/2019
CASING DIA./TYPE 2" PVC
SCREEN SLOT/TYPE 0.010-in.
FILTER PACK TYPE Natural
TOP OF CASING 172.84 Ft. AMSL
GROUND ELEVATION 172.57 Ft. AMSL
DEPTH TO WATER 0.3 Ft. BMP
WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
0	⁘	SP	0-5	100		SAND: black (10R 2/1); poorly graded; med; saturated	
5	⁘	SP	5-10	100		SAND: grey (5YR 6/1); poorly graded; med; organics	
	⁘	SP				SAND: dark yellowish brown (10YR 3/6) and brown (10YR 4/3); poorly graded	
	⁘	SP				SAND: very pale brown (10YR 7/3) and greyish brown (10YR 5/2); poorly graded	
10	⁘	SP	10-15	100		SAND: black (5YR 2.5/1); poorly graded; med; saturated	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB3D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

DRILLING COMPANY Betts

DRILLER C. Pendarvis

DRILLING METHOD Sonic

REMARKS

PROFESSIONAL T. Hall

DATE(S) DRILLED 12/5/2018

CASING DIA./TYPE 2" PVC

SCREEN SLOT/TYPE 0.010-in. slotted PVC

FILTER PACK TYPE

TOP OF CASING 172.13 Ft. AMSL

GROUND ELEVATION 172.09 Ft. AMSL

DEPTH TO WATER

WATER ELEVATION

U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE	OBSV. WELL DIAGRAM
	0-10	80		No Recovery		
SM				SAND, silty: light grayish brown (quartz); fine (50%); med (45%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%); organics (roots/grass)		
SM				SAND, silty: dark brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist		
SP				SAND: light grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<!%)		
SM				SAND, silty: dark yellowish brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist		
SM	10-20	80		SAND, silty: (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist		
SM				SAND, silty: black (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated		
SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; semi-consolidated; moist		
SM	20-30	60		SAND, silty: dark grayish brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist		
SP	30-40	80		SAND: grayish brown (quartz); fine (60%); med (40%); well sorted; subround; unconsolidated; FBG (<1%)		
SM				SAND, silty: dark brown (quartz); fine (50%); med (40%); coarse (5%); silt (<5%); well sorted; subround; unconsolidated; moist; FBG (<1%0		
				SAND: dark yellowish brown (quartz); fine (50%); med (40%);		

Continued Next Page

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB3D & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00
LOCATION Saint George, Georgia
PROFESSIONAL T. Hall
DATE(S) DRILLED 12/5/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE	OBSV. WELL DIAGRAM
		SP				coarse (10%); well sorted; subround; moist; FBG (<1%)		
40			40-50	90				
45								
50			50-60	90				
		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; moist; well consolidated		
		SP				SAND: dark yellowish brown (quartz); fine (50%); med (40%); coarse (10%); well sorted; subround; moist; FBG (<1%)		
55								
		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; moist; well consolidated		
		SP				SAND: yellowish brown (quartz); fine (60%); med (35%); coarse (5%); well sorted; subround; unconsolidated; moist; FBG (<1%)		
60		CL	60-70	90		CLAY, sandy: grayish brown; fine; well sorted; subround; moist; FBG (<1%)		
65								
		SP				SAND: light grayish brown (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)		
70			70-80	0		No Recovery		

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PROJECT NUMBER 000180200804.00
PROFESSIONAL T. Hall
LOCATION Saint George, Georgia
DATE(S) DRILLED 12/5/2018

Continued from Previous Page

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE	OBSV. WELL DIAGRAM
80	⁘	SP	80-90	80		SAND: light grayish brown (quartz); fine (75%); med (25%); well sorted; subround; unconsolidated; moist; FBG (<1%)		
85								
90						BORING TERMINATED AT 90 FEET.		

M:\PROJECTS\2018\000180200804.00 - TWIN PINES MINERALS PERMITTING SERVICES\804-LOGS RESTORED FROM 8-7\804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ 7/2/19 Report:ENV LOG - WELL

TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

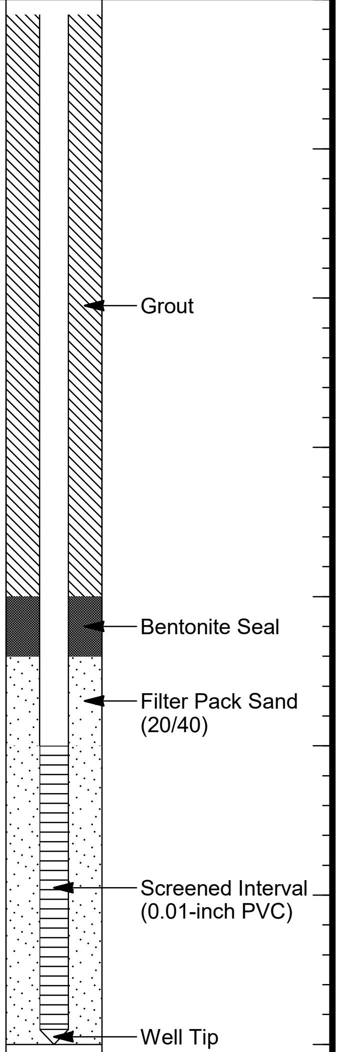
LOG OF OBSV. WELL OWB3S & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	T. Hall
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	12/5/2018
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in. slotted PVC
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	
		TOP OF CASING	171.76 Ft. AMSL
REMARKS		**GROUND ELEVATION**	171.69 Ft. AMSL
		DEPTH TO WATER	
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			0-10	70		No Recovery	
		SM				SAND, silty: dark brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist	
		SP				SAND: light grayish brown (quartz); fine (50%); med (50%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
5		SM				SAND, silty: dark yellowish brown (quartz); fine (60%); med (35%); well sorted; subround; unconsolidated; moist	
10		SM	10-20	80		SAND, silty: brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; unconsolidated; moist	
15		SM				SAND, silty: black (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; well consolidated; moist	
		SM				SAND, silty: very dark brown (quartz); fine (75%); med (20%); silt (<5%); well sorted; subround; semi-consolidated; moist	
20 25		SM	20-30	70		SAND, silty: dark grayish brown (quartz); fine (60%); med (35%); silt (<5%); well sorted; subround; unconsolidated; moist	
30		SP	30-35	200		SAND: grayish brown (quartz); silty; fine (60%); med (40%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
		SM				SAND, silty: dark brown (quartz); fine (50%); med (40%); silt (<5%); coarse (5%); well sorted; subround; unconsolidated; moist; FBG (<1%)	
35		SP				SAND: dark yellowish brown (quartz); silty; fine (50%); med (40%); coarse (10%); well sorted; subround; unconsolidated; FBG (<1%)	

BORING TERMINATED AT 35 FEET.

OBSV. WELL DIAGRAM



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TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

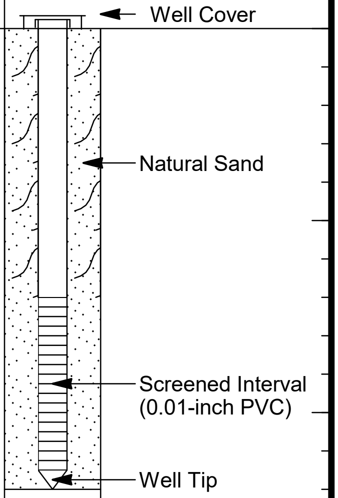
SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB4BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER	000180200804.00	**PROFESSIONAL**	A. Wiggins
LOCATION	Saint George, Georgia	**DATE(S) DRILLED**	1/30/2019
DRILLING COMPANY	Betts	**CASING DIA./TYPE**	2" PVC
DRILLER	C. Pendarvis	**SCREEN SLOT/TYPE**	0.010-in.
DRILLING METHOD	Sonic	**FILTER PACK TYPE**	Natural
		TOP OF CASING	172.68 Ft. AMSL
REMARKS		**GROUND ELEVATION**	172.40 Ft. AMSL
		DEPTH TO WATER	1 Ft. BMP
		WATER ELEVATION	

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE INTERVAL (feet)	SAMPLE % RECOVERY	SAMPLE PID (ppm)	LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
	⁘	SP	0-5	100		SAND: black (10R 2/1); poorly graded; med; saturated	
5	⁘	SP	5-10	100		SAND: yellowish brown (10YR 3/6) and brown (10YR 4/3); poorly graded; med; moist	
10			10-15	0		No Recovery	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



TWIN PINES MINERALS SAUNDERS-LONCALA RESERVE

SAINT GEORGE, GEORGIA

LOG OF OBSV. WELL OWB5BS & OBSV. WELL CONSTRUCTION

PROJECT NUMBER 000180200804.00

LOCATION Saint George, Georgia

DRILLING COMPANY Betts

DRILLER C. Pendarvis

DRILLING METHOD Sonic

REMARKS

PROFESSIONAL A. Wiggins

DATE(S) DRILLED 1/30/2019

CASING DIA./TYPE 2" PVC

SCREEN SLOT/TYPE 0.010-in.

FILTER PACK TYPE Natural

TOP OF CASING 172.80 Ft. AMSL

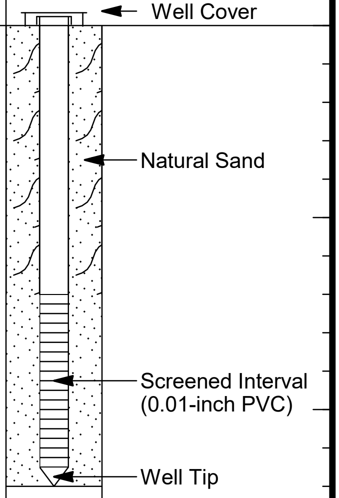
GROUND ELEVATION 172.56 Ft. AMSL

DEPTH TO WATER 0.8 Ft. BMP

WATER ELEVATION

DEPTH (feet)	GRAPHIC LOG	U.S.C.S.	SAMPLE			LITHOLOGIC DESCRIPTION	WATER LEVEL & DATE
			INTERVAL (feet)	% RECOVERY	PID (ppm)		
	⁘	SP	0-5	100		SAND: black (10YR 2/1); poorly graded; med; saturated	
5	⁘	SP	5-10	100		SAND: grey (5YR 6/1); poorly graded; med; organics	
	⁘	SP				SAND: dark yellowish brown (10YR 3/6) and brown (10YR 4/3); poorly graded	
	⁘	SP				SAND: very pale brown (10YR 7/3); and greyish brown (10YR 5/2); poorly graded	
10			10-15	0		No Recovery	
15						BORING TERMINATED AT 15 FEET.	

OBSV. WELL DIAGRAM



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APPENDIX B

HYDRO GEO CHEM, INC REPORT

HYDRO GEO CHEM, INC.
Environmental Science & Technology

September 11, 2019
Via Email: mtanner@ttlusa.com

Mark J. Tanner, P.G.
TTL, Inc.
Senior Principal Geologist
3516 Greensboro Avenue
Tuscaloosa, AL 35401

Re: Analysis of Pumping Tests at Twin Pines Site, Charlton County, Georgia

Dear Mr. Tanner:

This report describes the analysis of pumping rate and drawdown data collected during February 2019 from two pumping tests at the Twin Pines Site in Charlton County, Georgia. Testing was performed by TTL with oversight by Hydro Geo Chem, Inc. (HGC).

Introduction

Pumping tests were conducted at two production wells (PW-A and PW-B) installed by TTL along the approximately north-south oriented linear feature known as the 'Trail Ridge'. The Trail Ridge essentially bounds the east side of the Okefenokee Swamp.

The testing focused on saturated materials (the aquifer) extending from the water table (a few feet below land surface [ft bls] over most of the Site) to approximately 120 ft bls where a relatively impermeable unit is present. Both production wells were screened between approximately 55 and 115 ft bls and therefore partially penetrated the aquifer. Although the aquifer is generally considered unconfined, a 'black sand' present at depths between approximately 10 and 20 ft bls (5 and 15 feet below the water table) may act as a partial hydraulic barrier. Under these conditions the aquifer below the 'black sand' may be considered leaky confined.

Observation well nests were installed by TTL at distances of approximately 50, 100 and 300 feet from each production well. Observation wells in the two closest nests were completed at depths of approximately 12, 35 and 90 ft bls (designated BS, S, and D, respectively); the farthest (300 foot) nests contained only 35 and 90 ft bls completions (S and D, respectively).

The shallower wells (BS and S) were completed above the screened interval of the associated pumped well whereas the deep well (D) was completed within the screened interval of the associated pumped well. The shallowest wells (BS-series) were screened near or across the water table and above the 'black sand'. Test A nests were designated OWA-1 BS/S/D (50 ft distant); OWA-2 BS/S/D (100 feet distant); and OWA-3 S/D (300 feet distant). Test B nests were designated OWB-1 BS/S/D (50 ft distant); OWB-2 BS/S/D (100 feet distant); and OWB-3 S/D (300 feet distant).

Additional shallow (BS-series) wells were installed at distances of 50 and 100 feet at both test locations. For test A these were designated OWA-3BS and OWA-4BS (50 feet distant) and OWA-5BS (100 feet distant); For test B these were designated OWB-3BS and OWB-4BS (50 feet distant) and OWB-5BS (100 feet distant). Maps showing the locations of observation wells in relation to the pumping well for each test are provided in Appendix A.

Tests consisted of pumping each production well (PW-A and PW-B) at three rates (pumping steps) over a 24-hour period while monitoring water levels in the pumped wells and in the observation wells located (as described above) at distances of up to 300 feet. Water levels were continuously monitored using In-Situ LevelTroll 700 pressure transducer/data loggers supplied by TTL. Pumping rates were periodically monitored using in-line flow meters installed on the pump discharge lines. Pumped water was discharged at locations remote from the pumped wells (approximately 1000 feet away) to ensure that the discharge would not impact the tests. Rainfall occurred during a portion of the testing but did not appear to have a measurable impact on the water level data.

Upon cessation of pumping, data loggers remained within the monitored installations until sufficient water level recovery data were collected.

Pumping Test Data Reduction

Water level data collected from each monitored well during each pumping test were converted to water level displacements (drawdowns) by subtracting the measured depths to water from the depths to water measured immediately prior to each test.

Automatically-logged data collected by TTL at 5-second intervals (using the In-Situ pressure transducers/data loggers) were reduced in number to be compatible with software input requirements and to allow for reasonably rapid automatic parameter estimation. The first 10 measurements from each pumping step (or recovery period) were retained. Subsequently, the time interval between retained measurements was systematically increased. Figure 1 compares all automatically-logged data from observation well OWA-1D to the reduced data set for that well. As shown, the reduced data set adequately represents the complete data set, in particular, changes in the data at times that pumping rates changed.

Automatically-logged drawdown data were plotted and analyzed for quality and to determine if corrections were needed based on any background trends observed or for correlation with changes in atmospheric pressure. In some cases when behavior was not as expected automatically-logged data were compared with hand-collected data. For example, drawdowns at OWB-1S and OWB-2S appeared nearly identical even though OWB-2S is located twice as far from pumping well PW-B. However, as shown in Figures 2 and 3, automatically-logged and hand-collected data for OWB-1S and OWB-2S are nearly identical. Where comparisons were made, the automatically-logged data were judged sufficiently similar to the hand-collected data that there was no need to analyze the hand-collected data independently. However, should significant differences have been present, the hand-collected data would have served as an independent back-up for the automatically-logged data.

In general, drawdowns obtained from all but the shallowest (water table) wells required no correction for trends or changes in barometric pressure, primarily because drawdowns were orders of magnitude larger than any ‘noise’ attributable to other factors. Data from PW-A test water table wells (OWA-1BS through OWA-5BS) showed either no responses to pumping or responses that were too small to be detected due to noise. However, data from PW-B test water table wells OWB-2BS, OWA-3BS, OWB-4BS, and OWB-5BS, although noisy, showed unambiguous responses to pumping, and were corrected for background trends prior to quantitative analysis as shown in Figure 4.

Pumping Test Analysis and Results

Qualitative analysis of water level drawdown data indicated that quantitatively analyzable data were obtained from PW-A, PW-B, and all observation wells equipped with In-Situ data loggers/pressure transducers except for water table wells OWA-1BS through OWA-5BS, and OWB-1BS, which, as discussed above, showed either no responses to pumping, or responses that were too small to be detected due to noise. Figures 5 and 6 plot drawdowns from test A and test B observation well nests, respectively, but do not include drawdowns from the water table wells.

Important results of the qualitative analysis are:

1. The ratio of shallow observation well drawdowns to deep observation well drawdowns increases substantially with distance from the pumping wells. This ratio is generally expected to approach 1.0 at large distance from the pumping well, but unexpectedly exceeds 1.0 at the more distant observation well nests at both test locations. This behavior contradicts expectation because the deep observation wells are completed within the screened depth of the pumping well, and the shallow observation wells are completed above the screened depth of the pumping well. At 50 and 100 feet from PW-A, the deep observation well drawdowns exceed the shallow observation well drawdowns as expected; however, at 300 feet from PW-A (OWA-3 nest), the shallow drawdowns consistently exceed the deep drawdowns. At 50 feet from PW-B, the deep observation well drawdowns exceed the shallow observation well drawdowns as expected; however at 100 feet from PW-B (OWB-2 nest), the early shallow drawdowns exceed the deep drawdowns; and at 300 feet (OWB-3 nest), the shallow drawdowns consistently exceed the deep drawdowns. The data suggest non-horizontal structure within the aquifer which may violate the assumption of horizontal flow used in the analytical solutions. In all cases, however, the shapes of the shallow drawdowns are similar, and flatten substantially during each step; likewise, the shapes of the deep drawdowns are similar, but flatten less than the shallow drawdowns. These characteristic shapes demonstrate that shallow and deep drawdown data did not get accidentally ‘mixed up’ at any of the nests.

2. Flattening of pumping and observation well drawdowns occur late in each pumping step. Flattening is consistent with another source of water: either local wetlands; vertical leakage from the shallowest groundwater through the underlying ‘black sand’; or both. A

> substantial amount of water appears to be available for vertical leakage. Smaller flattening of the deep observation well drawdowns indicating that the deeper portion of the aquifer is less impacted by the additional source of water suggests a shallow source.

Quantitative analysis of pumping rate and water level drawdowns included use of AQTESOLVE (HydroSolve, 2000) and WHIP^{TM} (HGC, 1988), a well hydraulics interpretation program developed and marketed by HGC. PW-A and PW-B pumping rates used as input in analyzing the test data are displayed in Figure 7.

Analytical solutions used in AQTESOLVE included the Neuman unconfined and Neuman-Witherspoon leaky confined solutions. Because small drawdowns were detectable at the water table during test B, and could not definitively be ruled out during test A, the aquifer can be considered unconfined. However, because the 'black sand' at depths between approximately 5 and 15 feet below the water table appears to be a partial hydraulic barrier, the aquifer may also be considered leaky confined. Assuming leaky confined conditions, the black sand is considered an 'aquitard', and the portions of the saturated zone above and beneath this layer are considered the 'unpumped' and 'pumped' aquifers, respectively. Under all conditions, the base of the aquifer was assumed to be 120 feet below land surface (bls), or approximately 115 feet beneath the water table.

The Neuman unconfined solution accounts for partial penetration of both pumping and observation wells within the aquifer. Although the Neuman-Witherspoon leaky aquifer solution cannot account for partial penetration of wells, it can compute drawdowns in both the pumped and unpumped aquifers.

The analytical solution used in WHIP was the vertically anisotropic leaky aquifer solution. This solution allows for automatic parameter estimation, accounts for wellbore storage at pumping wells, for partial penetration of both pumping and observation wells within the pumped aquifer, and for vertical leakage from the unpumped aquifer through an aquitard assuming constant head in the unpumped aquifer.

In performing the analyses, when assuming unconfined conditions, the pumped aquifer was taken to be 115 feet thick (water table to 120 feet bls); and when assuming leaky confined conditions the pumped aquifer was taken to be 100 feet thick (base of aquitard to 120 feet bls). In performing leaky confined analyses the shallow (screened approximately 25-35 feet bls [20 to 30 feet below the water table]) and deep (screened approximately 80-90 feet bls [75 to 85 feet beneath the water table]) observation wells were taken to be completed within the pumped aquifer; and the shallowest water table wells were taken to be completed within the shallow unpumped aquifer above the aquitard.

Estimates of transmissivity (T) and storage coefficient (S) were obtained by analyzing data from pumping and observation wells separately, and by considering pairs of observation wells. Because by design both pumping and observation wells partially penetrated the aquifer, analyses were sensitive to the vertical hydraulic conductivity of the aquifer, and estimates of vertical hydraulic conductivity were also obtained.

Good fits between measured and simulated water level drawdowns at pumping and observation wells could not be obtained using only one set of hydraulic parameters, consistent with heterogeneity. Likewise, at individual observation well nests, one set of hydraulic parameters could not provide good fits to both deep and shallow well drawdowns; a good fit to either a deep or shallow well drawdown generally means a poor fit to the drawdown at the other well.

Tables 1 and 2 provide the results of the analyses. Appendices B through E show the quality of fit between measured and simulated drawdowns, and reproduce the parameters used in each analysis. Appendices B and C provide fits for test A data using AQTESOLVE and WHIP, respectively; likewise Appendices D and E provide fits for test B data using AQTESOLVE and WHIP, respectively. T (and horizontal hydraulic conductivity [Kh]) estimates for test A are generally larger than for test B, consistent with the larger pumping rates achievable for test A. Estimates of aquifer vertical hydraulic conductivity (Kv) and aquitard vertical hydraulic conductivity (Kv aqt) range over several orders of magnitude, are nearly always lower than the corresponding Kh estimates, and are generally lower for test B than for test A. What appear to be unreasonably large transmissivity and storage coefficient (T2 and S2) estimates for the unpumped aquifer in some cases are consistent with flattening of drawdowns and a substantial source of water available for vertical leakage.

In general, when analyzing wells separately, good agreement between measured and simulated data at both pumping and observation wells can be obtained (Appendices B through E). The generally good agreement between measured and simulated data at both pumping wells PW-A and PW-B suggest that the hydraulic parameters obtained are representative of average aquifer conditions near the pumping wells. Good fits were obtained without specifying a well efficiency correction, indicating that the wells were properly designed, reasonably efficient and well developed.

For test A (Table 1), estimates of T and S from pumping well PW-A data range from 1490 ft^2/day to 1967 ft^2/day and from 3.5×10^{-4} to 1.1×10^{-2}. Although estimates of T from observation well data range from approximately 1 ft^2/day to 2288 ft^2/day, the majority of estimates are lower than for the pumping well and average 875 ft^2/day. Estimates of S from observation well data range from approximately 1.6×10^{-5} to 1.7×10^{-2}; estimates of Kh range from <1 to 20 ft/day; estimates of Kv range from 0.06 ft/day to 1.8 ft/day; and estimates of Kv aqt range from 2.4×10^{-6} ft/day to 0.75 ft/day. The lowest T of 1 ft^2/day was derived from one interpretation of data from OWA-3D, where, due to non-uniqueness, T estimates from alternate interpretations ranged from 1 ft^2/day to 1700 ft^2/day.

For test B (Table 2), estimates of T and S from pumping well PW-B data range from 530 ft^2/day to 697 ft^2/day and from 2.4×10^{-3} to 0.11. T estimates from the shallowest water table well data that range from 5455 ft^2/day to 9500 ft^2/day based on Neuman unconfined analysis are considered unreasonably large and unreliable. Excluding these estimates, observation well data yield T estimates ranging from approximately 53 ft^2/day to 1100 ft^2/day; however, the majority of the estimates are lower than for the pumping well and average 432 ft^2/day. Estimates of S from observation well data range from approximately 1×10^{-10} to 5×10^{-3}; estimates of Kh range from <1 to 11 ft/day; estimates of Kv range from 8.6×10^{-5} ft/day to 1.5 ft/day; and estimates of Kv aqt range from 1.1×10^{-6} ft/day to 0.3 ft/day.

As discussed above, solutions to individual wells may be highly non-unique; for example at OWB-1D (Table 2), T estimates from alternate interpretations using the Neuman unconfined solution vary from 478 to 901 ft^2/day and Kv estimates from 9.3 x 10^{-3} to 1.42 ft/day even though acceptable fits are obtained in each case (Appendix D). An extreme example from test A is OWA-3D (Table 1) where acceptable fits (Appendix B) using Neuman-Witherspoon are obtained with a T and Kv aqt of 1700 ft^2/day and 6.8 x 10^{-6} ft/day; and with a T and Kv aqt of 1.3 ft^2/day and 0.4 ft/day. Analyses incorporating multiple observation wells, which are presumably more constrained, need to be considered in deciding which of the alternate interpretations of individual well drawdowns are the most reasonable.

In addition, the Kh estimates obtained from the pumping well drawdowns are expected to be representative of overall ‘average’ behavior of the pumped aquifer. Furthermore, generally higher T estimates from pumping well data appear consistent with heterogeneity that results in a non-horizontal conductivity tensor. Such heterogeneity could be caused by non-horizontal structure within the sands. Pumping well drawdowns may be less impacted by any non-horizontal structure because water could be supplied mainly along (rather than across) such structure; and observation well drawdowns, which would result from flow across such structure, could be controlled by some average of the conductivities along and perpendicular to the structure.

Conclusions

The results of the both qualitative and quantitative analyses are consistent with the following observations/conclusions:

1. Results of quantitative analysis (Tables 1 and 2) indicate that both pumping wells are efficient and properly designed and developed (negligible skin effects or non-linear losses).
2. T estimates are generally higher at the test A site compared to the test B site, consistent with the larger achievable pumping rates at the test A site. Except for a few outliers, Kh estimates computed from T estimates generally range from several ft/day to nearly 20 ft/day for test A, and from a few ft/day to as much as 11 ft/day for test B, with some outliers exceeding 50 ft/day. These test B Kh outliers were computed based on data from the shallowest (water table) observation wells using the Neuman unconfined solution and are not considered reliable.
3. Heterogeneity possibly resulting from non-horizontal structure within the sands may be present within the pumped aquifer. Such heterogeneity may result in more direct connection between the pumping and shallow observation wells at larger distances from the pumping wells.
4. Such heterogeneity would be consistent with the substantial increase in the ratio of shallow observation well drawdowns to deep observation well drawdowns with distance from the pumping wells, and the unexpected increase in this ratio above 1.0 at the more distant observation well nests.

5. Due to such heterogeneity, the assumption that flow would be strictly horizontal were it not for partial penetration of pumping wells, is likely violated. Kh and Kv estimates from observation well data will represent some average of Kh along the structure and Kv perpendicular to the structure. However, analyses of observation well data likely yield the 'effective' horizontal conductivity that will control eastward migration of groundwater from the area of the Okefenokee swamp through Trial Ridge.
6. Flattening of pumping well and shallow observation well drawdowns is consistent with another (presumably shallow) source of water, either local wetlands or vertical leakage from the shallowest groundwater through the shallow 'black sand', or both. Substantially less flattening of the deep observation well drawdowns indicates that the deeper portion of the aquifer is less impacted by the additional source of water.

Although heterogeneity potentially resulting from non-horizontal structure may be present, eastward flow from the area of the Okefenokee swamp through Trail Ridge is expected to be sub-horizontal, and to be governed by the 'effective' horizontal conductivities yielded through analysis of pumping test observation well data.

References

HGC. 1988. WHIP. Well Hydraulics Interpretation Program. Version 3.22. User's Manual. July 1988.

HydroSOLVE, Inc. 2000. AQTESOLV for Windows. User's Guide.

Please feel free to call me at (520) 293-1500 Ext. 122 or by email at stewarts@hgcinc.com if you have any questions.

Sincerely,
HYDRO GEO CHEM, INC.

Stewart J. Smith, P.G.
Associate Hydrogeologist

Attachments:
- Tables 1 and 2
- Figures 1 through 7
- Appendix A: Observation Well Locations
- Appendix B: AQTESOLVE PWA Test Plots
- Appendix C: WHIP PWA Test Plots
- Appendix D: AQTESOLVE PWB Test Plots
- Appendix E: WHIP PWB Test Plots

TABLES

TABLE 1
PW-A Aquifer Test Hydraulic Parameter Estimates

Observation Well (s)	Bottom of Screen Depth (ft)	Solution	T (ft^2/day)	S	Specific Yield	Kv (ft/day)	Kv aquitard (ft/day)	b (ft)	Kh (ft/day)	recom-mended	Comment
PW-A	115	Neuman Unconfined	1967	3.5E-04	2.9E-03	0.2	NA	115	17.1	x	
PW-A	115	Vert. Anisotropic Leaky	1490	1.1E-02	NA	1.0	0.40	115	13.0	x	analysis using WHIP
OWA-1D	90	Neuman Unconfined	1475	8.5E-03	0.50	0.3	NA	115	12.8	x	
OWA-2D	90	Neuman Unconfined	1319	4.8E-03	2.9E-02	0.3	NA	115	11.5	x	
OWA-3D	90	Neuman Unconfined	2288	1.7E-02	0.03	1.08	NA	115	19.9	x	
OWA-1S	35	Neuman Unconfined	1351	4.3E-03	0.50	1.8	NA	115	11.7	x	
OWA-2S	35	Neuman Unconfined	1820	3.4E-03	0.50	1.6	NA	115	15.8		
OWA-3S	35	Neuman Unconfined	680	5.5E-05	2.2E-02	0.06	NA	115	5.9	x	
OWA-1D	90	[1]Neuman-Witherspoon	914	2.2E-03	NA	NA	3.7E-06	100	9.1		T2=1.44e8 ft^2/d; S2=1e-10
OWA-1D	90	[1]Neuman-Witherspoon	356	7.3E-05	NA	NA	4.4E-01	100	3.6	x	T2=4170 ft2/d; S2=0.0149; improved fit
OWA-2D	90	[1]Neuman-Witherspoon	1017	1.2E-03	NA	NA	4.1E-06	100	10.2		T2=1.44e8 ft^2/d; S2=1e-10
OWA-2D	90	[1]Neuman-Witherspoon	422	8.8E-04	NA	NA	0.152	100	4.2	x	T2=4850 ft2/d; S2=1.01e-10; improved fit
OWA-3D	90	[1]Neuman-Witherspoon	1700	7.0E-03	NA	NA	6.8E-06	100	17.0		T2=1.44e8 ft^2/d; S2=2.7e-5
OWA-3D	90	[1]Neuman-Witherspoon	331	3.4E-03	NA	NA	0.383	100	3.3	x	T2=4272 ft2/d; S2=9.91e-3; improved fit
OWA-3D	90	[1]Neuman-Witherspoon	1.3	1.0E-04	NA	NA	0.396	100	0.013		T2=4520 ft^2/d; S2=0.005
OWA-1D	90	Vert. Anisotropic Leaky	360	1.6E-05	NA	0.70	0.68	100	3.6	x	analysis using WHIP; Ss aqt = 5.39e-3
OWA-1D	90	Vert. Anisotropic Leaky	543	1.4E-03	NA	1.01	0.32	100	5.4	x	fit recovery w/WHIP; Ss aqt = 5.04e-3
OWA-2D	90	Vert. Anisotropic Leaky	337	1.6E-05	NA	0.29	0.24	100	3.4	x	analysis using WHIP; Ss aqt = 2.01e-3
OWA-2D	90	Vert. Anisotropic Leaky	665	9.8E-04	NA	0.19	0.13	100	6.7	x	fit recovery w/WHIP; Ss aqt = 1.85e-3
OWA-3D	90	Vert. Anisotropic Leaky	323	1.6E-05	NA	0.17	0.17	100	3.2	x	analysis using WHIP; Ss aqt = 2.10e-3
OWA-1S	35	Vert. Anisotropic Leaky	592	1.6E-05	NA	0.8	0.73	100	5.9	x	analysis using WHIP; Ss aqt = 1.77e-3
OWA-2S	35	Vert. Anisotropic Leaky	354	1.6E-05	NA	0.4	0.67	100	3.5	x	analysis using WHIP; Ss aqt = 9.54e-4
OWA-3S	35	Vert. Anisotropic Leaky	326	1.6E-05	NA	0.11	0.05	100	3.3	x	analysis using WHIP; Ss aqt = 2.76e-5
OWA-1D/3D	90/90	Neuman Unconfined	946	1.2E-02	0.06	1.27	NA	115	8.2	x	
OWA-1D/3D	90/90	[1]Neuman-Witherspoon	596	9.8E-04	NA	NA	2.4E-06	100	6.0	x	T2=1.44e8 ft^2/d; S2=1e-10
OWA-1S/D	35/90	Neuman Unconfined	1136	1.1E-02	0.5	0.8	NA	115	9.9	x	
OWA-1S/D	35/90	Neuman Unconfined	1154	1.0E-02	0.25	0.8	NA	115	10.0		alt interp
OWA-1S/D	35/90	Neuman Unconfined	926	1.1E-02	0.50	1.6	NA	115	8.1		early time interp
OWA-2S/D	35/90	Neuman Unconfined	866	5.3E-03	3.3E-02	0.8	NA	115	7.5		
OWA-2S/D	35/90	Neuman Unconfined	1141	5.8E-03	0.50	1.0	NA	115	9.9		early time interp
OWA-2S/D	35/90	Neuman Unconfined	1319	4.8E-03	0.029	0.29	NA	115	11.5	x	alt interp
OWA-2S/D	35/90	Neuman Unconfined	1800	2.0E-03	0.50	1.6	NA	115	15.7		alt interp
OWA-1S/D	35/90	Vert. Anisotropic Leaky	355	1.6E-05	NA	0.5	0.75	100	3.6	x	analysis using WHIP; Ss aqt = 5.12e-3
OWA-2S/D	35/90	Vert. Anisotropic Leaky	329	1.6E-05	NA	0.1	0.30	100	3.3	x	analysis using WHIP; Ss aqt = 2.05e-3
OWA-1D/2D/3D	90/90/90	Neuman Unconfined	1307	7.7E-03	0.50	0.43	NA	115	11.4	x	
OWA-1D/2D/3D	90/90/90	[1]Neuman-Witherspoon	718	1.3E-03	NA	NA	2.9E-06	100	7.2	x	T2=1.44e8 ft^2/d; S2=1e-10

Notes:

[1] = leaky aquifer; partial penetration of wells not represented
T = Transmissivity in feet squared per day (ft2/day)
T2 = Transmissivity of unpumped aquifer
S = Storage coefficient
S2 = Storage coefficient of unpumped aquifer
Ss = Specific storage of aquitard (storage per foot of thickness [1/ft])
Kh = horizontal hydraulic conductivity in feet per day (ft/day) calculated as T/b
Kv =vertical hydraulic conductivity in feet per day (ft/day)
b = Assumed aquifer thickness in feet

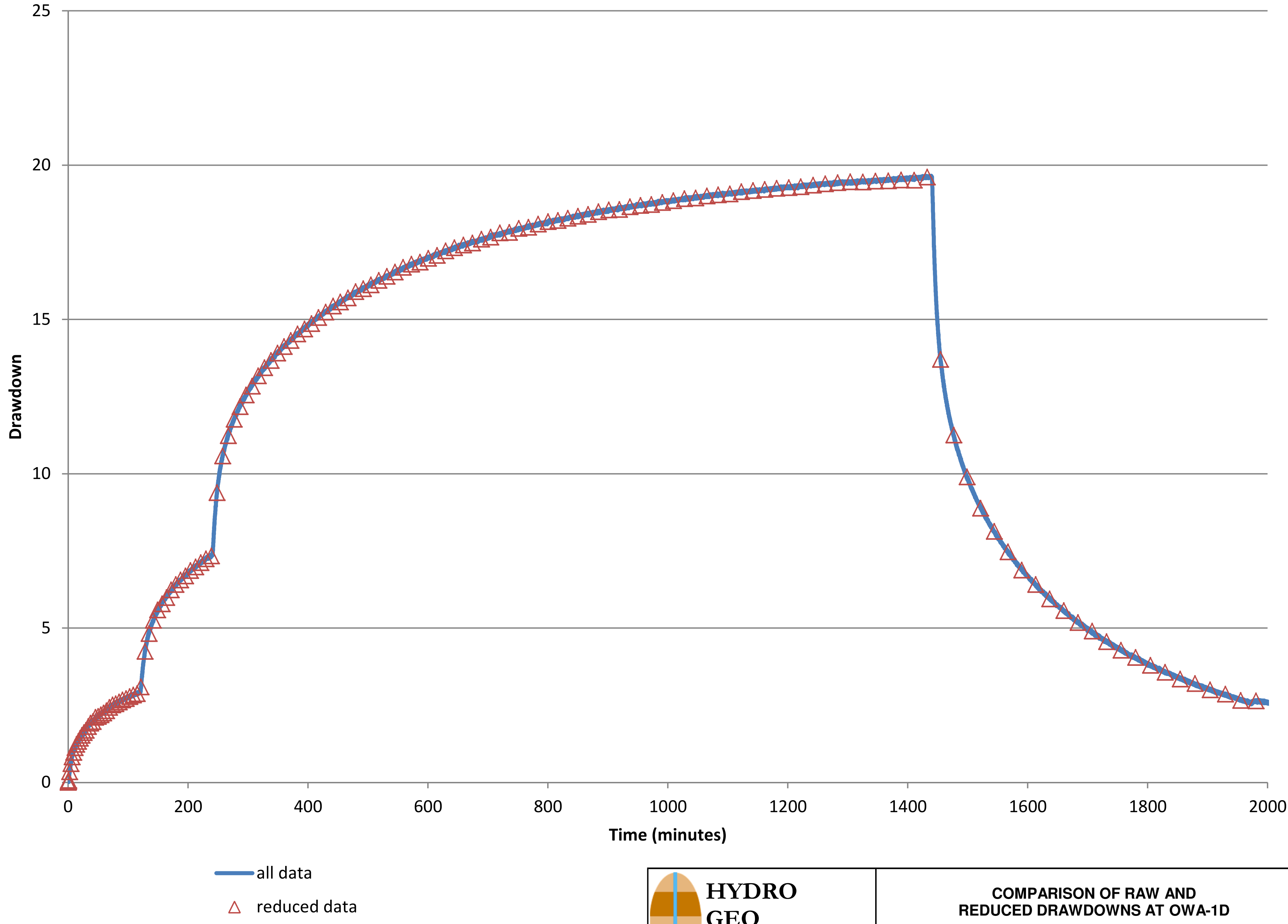
TABLE 2
PW-B Aquifer Test Hydraulic Parameter Estimates

Observation Well (s)	Bottom of Screen Depth (ft)	Solution	T (ft^2/day)	S	Specific Yield	Kv (ft/day)	Kv aquitard (ft/day)	b (feet)	Kh (ft/day)	recom-mended	Comment
PW-B	115	Neuman Unconfined	697	2.42E-03	1.00E-03	0.61	NA	115	6.1	x	
PW-B	115	Vert. Anisotropic Leaky	530	0.11	NA	0.55	0.10	115	4.6	x	analysis using WHIP; Ss aqt = 0.01
OWB-1D	90	Neuman Unconfined	478	2.92E-03	1.00E-03	1.42	NA	115	4.2		
OWB-1D	90	Neuman Unconfined	530	4.96E-03	1.00E-03	0.47	NA	115	4.6		alternate interp; improved fit
OWB-1D	90	Neuman Unconfined	901	3.20E-03	1.00E-03	9.29E-03	NA	115	7.8	x	alternate interp; additionally improved fit
OWB-2D	90	Neuman Unconfined	442	2.95E-03	1.00E-03	0.88	NA	115	3.8		
OWB-2D	90	Neuman Unconfined	808	4.78E-03	0.25	1.79E-02	NA	115	7.0	x	alternate interp; improved fit
OWB-3D	90	Neuman Unconfined	475	1.32E-03	0.50	4.34E-02	NA	115	4.1	x	
OWB-3D	90	Neuman Unconfined	674	3.43E-03	0.25	9.20E-03	NA	115	5.9		alternate interp; poorer fit
OWB-1S	35	Neuman Unconfined	224	1.19E-04	4.58E-03	2.12E-02	NA	115	1.9	x	
OWB-2S	35	Neuman Unconfined	221	2.96E-05	1.13E-03	5.17E-03	NA	115	1.9	x	
OWB-3S	35	Neuman Unconfined	246	3.09E-05	1.00E-03	4.88E-03	NA	115	2.1	x	
OWB-2BS	12	Neuman Unconfined	5455	1.37E-04	1.78E-02	1.02E-02	NA	115	47.4		unreasonably high T
OWB-3BS	12	Neuman Unconfined	6148	5.00E-05	2.00E-03	3.50E-03	NA	115	53.5		unreasonably high T
OWB-4BS	12	Neuman Unconfined	6918	4.84E-05	0.25	3.50E-03	NA	115	60.2		unreasonably high T
OWB-5BS	12	Neuman Unconfined	9499	3.75E-05	0.25	3.50E-03	NA	115	82.6		unreasonably high T
OWB-1D	90	[1]Neuman-Witherspoon	445	1.79E-03	NA	NA	5.41E-03	100	4.5	x	T2=1.44e8 ft^2/d; S2=1.0
OWB-2D	90	[1]Neuman-Witherspoon	405	2.34E-03	NA	NA	7.70E-03	100	4.1	x	T2=1.44e8 ft^2/d; S2=1.0
OWB-3D	90	[1]Neuman-Witherspoon	285	1.32E-03	NA	NA	1.14E-06	100	2.9		T2=1.44e8 ft^2/d; S2=6.03e-9
OWB-3D	90	[1]Neuman-Witherspoon	211	1.11E-03	NA	NA	1.40E-02	100	2.1	x	alt. interp; T2=1050 ft^2/d; S2=1.0e-10
OWB-3D	90	[1]Neuman-Witherspoon	52.9	1.38E-04	NA	NA	2.88E-02	100	0.5	x	alt. interp.; T2=671 ft^2/d; S2=1.39e-3
OWB-3BS	12	[1]Neuman-Witherspoon	1100	4.23E-04	NA	NA	0.309	100	11.0		T2=5.7e4 ft^2/d; S2=0.011, high T
OWB-4BS	12	[1]Neuman-Witherspoon	204	1.16E-05	NA	NA	2.16E-03	100	2.0	x	T2=2.56e5 ft^2/d; S2=1.19e-5
OWB-5BS	12	[1]Neuman-Witherspoon	206	1.16E-05	NA	NA	1.97E-03	100	2.1	x	T2=3.67e5 ft^2/d; S2=1.9e-5
OWB-1D	90	Vert. Anisotropic Leaky	201	1.05E-05	NA	0.367	6.16E-02	100	2.0	x	analysis using WHIP; Ss aqt = 0.0115
OWB-2D	90	Vert. Anisotropic Leaky	134	1.06E-05	NA	0.477	7.25E-02	100	1.3	x	analysis using WHIP; Ss aqt = 1.88e-3
OWB-3D	90	Vert. Anisotropic Leaky	67	3.56E-05	NA	8.92E-02	1.61E-02	100	0.7	x	analysis using WHIP; Ssaqt = 4.30e-4
OWB-1S	35	Vert. Anisotropic Leaky	121	1.05E-05	NA	0.955	0.299	100	1.2	x	analysis using WHIP; Ss aqt = 1.42e-3
OWB-2S	35	Vert. Anisotropic Leaky	174	1.00E-05	NA	1.00	8.26E-02	100	1.7	x	analysis using WHIP; Ss aqt = 5.84e-4
OWB-3S	35	Vert. Anisotropic Leaky	312	1.07E-10	NA	0.252	1.77E-03	100	3.1	x	analysis using WHIP; Ss aqt = 5.04e-4
OWB-2D/-3D	90/90	Neuman Unconfined	960	3.31E-03	1.00E-03	8.62E-05	NA	115	8.3	x	
OWB-1D/-3D	90/90	Neuman Unconfined	924	3.01E-03	0.25	3.00E-03	NA	115	8.0	x	
OWB-1S/-1D	35/90	Neuman Unconfined	593	1.00E-03	1.00E-03	1.51	NA	115	5.2	x	
OWB-1S/-1D	35/90	Neuman Unconfined	575	1.30E-03	1.00E-03	1.51	NA	115	5.0	x	alternate interp
OWB-2S/-2BS	35/12	[1]Neuman-Witherspoon	517	1.13E-03	NA	NA	1.80E-02	100	5.2	x	T2=5.03e4 ft^2/d; S2=2.59e-3
OWB-1S/-1D	35/90	Vert. Anisotropic Leaky	120	1.05E-05	NA	0.958	0.276	100	1.2	x	analysis using WHIP; Ss aqt = 2.04e-3

Notes:

[1] = leaky aquifer; partial penetration of wells not represented
T = Transmissivity in feet squared per day (ft2/day)
T2 = Transmissivity of unpumped aquifer
S = Storage coefficient
S2 = Storage coefficient of unpumped aquifer
Ss = Specific storage of aquitard (storage per foot of thickness [1/ft])
Kh = horizontal hydraulic conductivity in feet per day (ft/day) calculated as T/b
Kv =vertical hydraulic conductivity in feet per day (ft/day)
b = Assumed aquifer thickness in feet

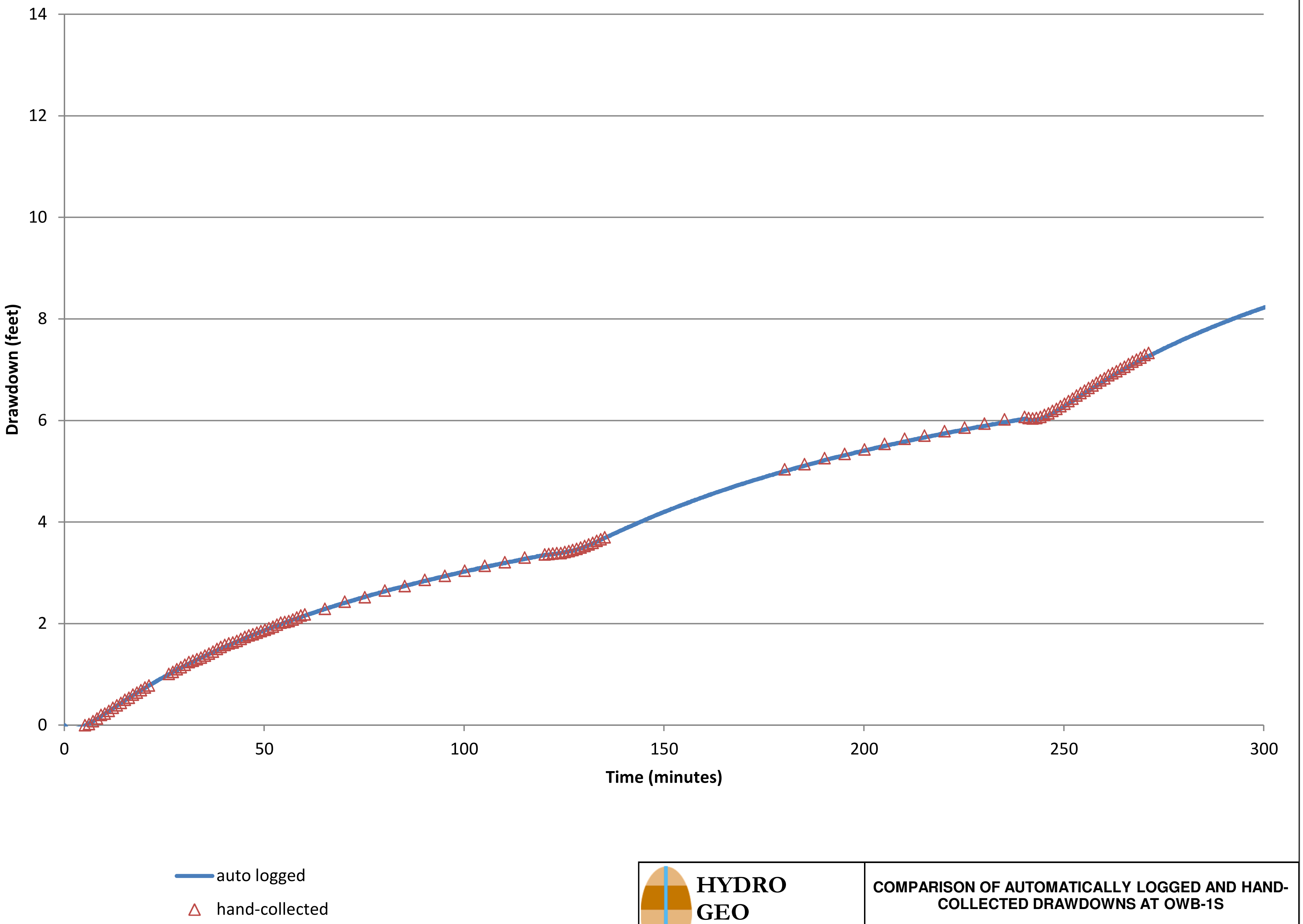
FIGURES



HYDRO GEO CHEM, INC.

COMPARISON OF RAW AND REDUCED DRAWDOWNS AT OWA-1D

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		1

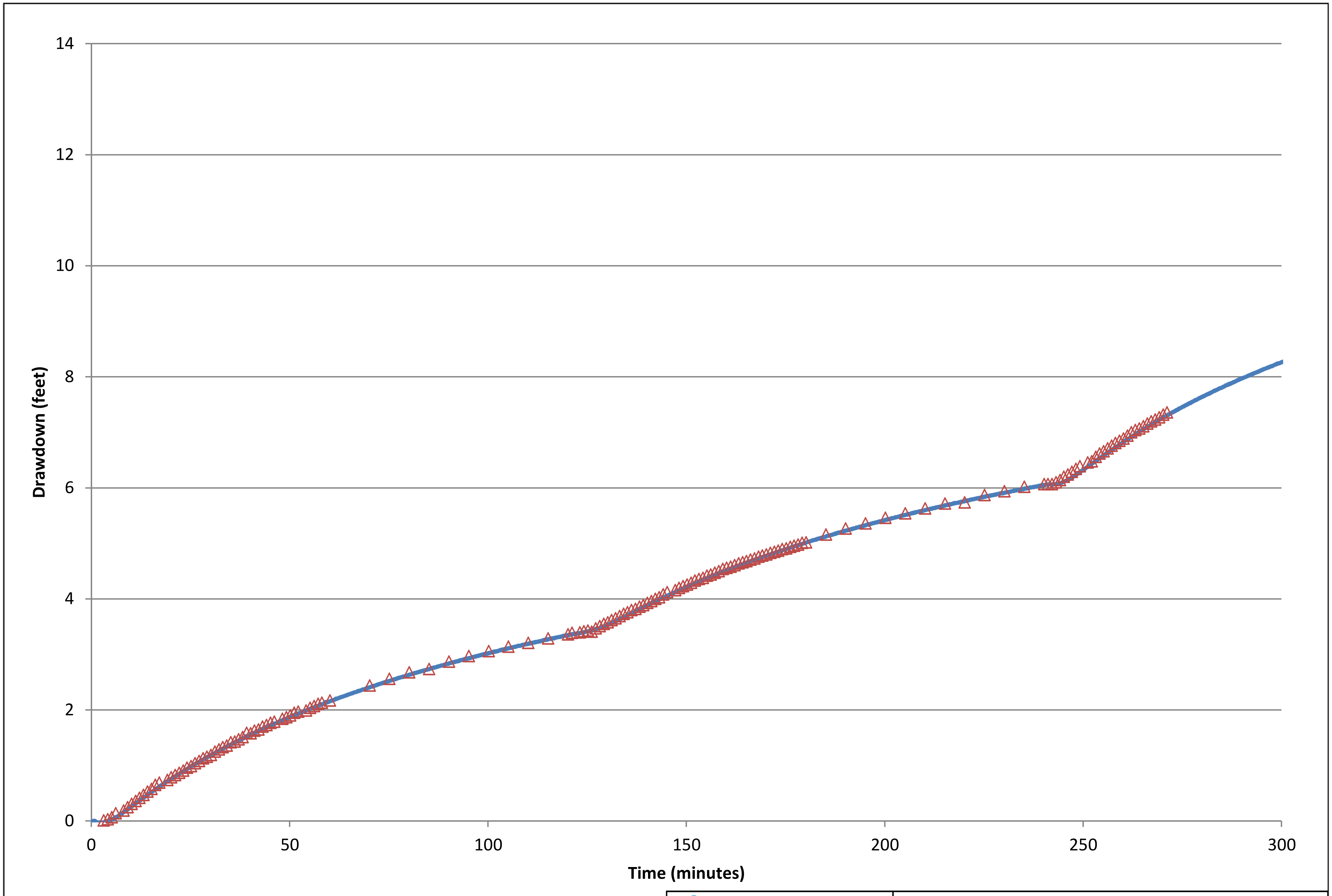


HYDRO GEO CHEM, INC.

COMPARISON OF AUTOMATICALLY LOGGED AND HAND-COLLECTED DRAWDOWNS AT OWB-1S

Approved	Date	Author	Date	File Name	Figure
SJS	**4/16/19**	**SJS**	**4/16/19**		**2**

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 2



— auto logged

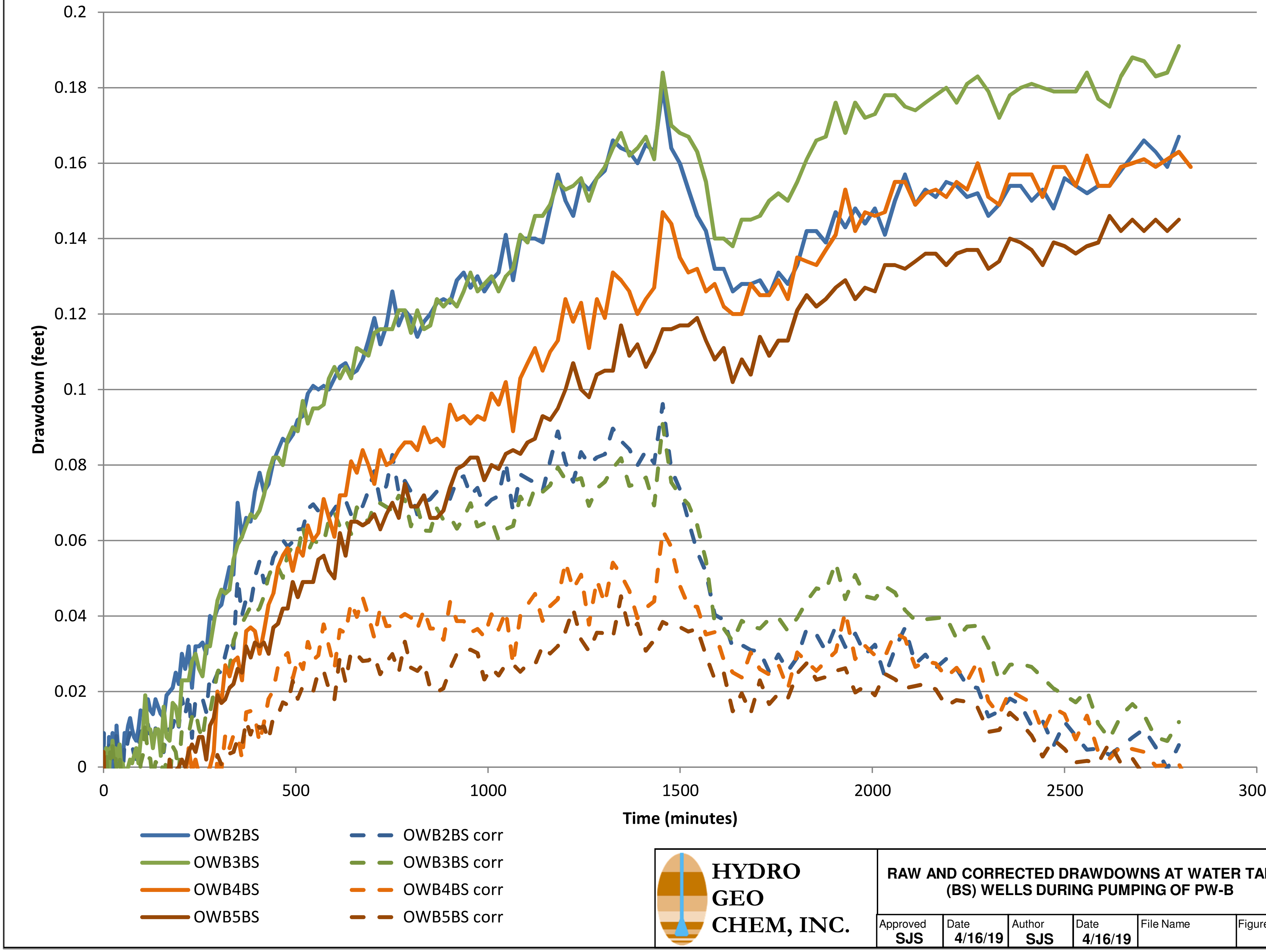
△ hand-collected

**HYDRO
GEO
CHEM, INC.**

COMPARISON OF AUTOMATICALLY LOGGED AND HAND-COLLECTED DRAWDOWNS AT OWB-2S

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		3

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 3

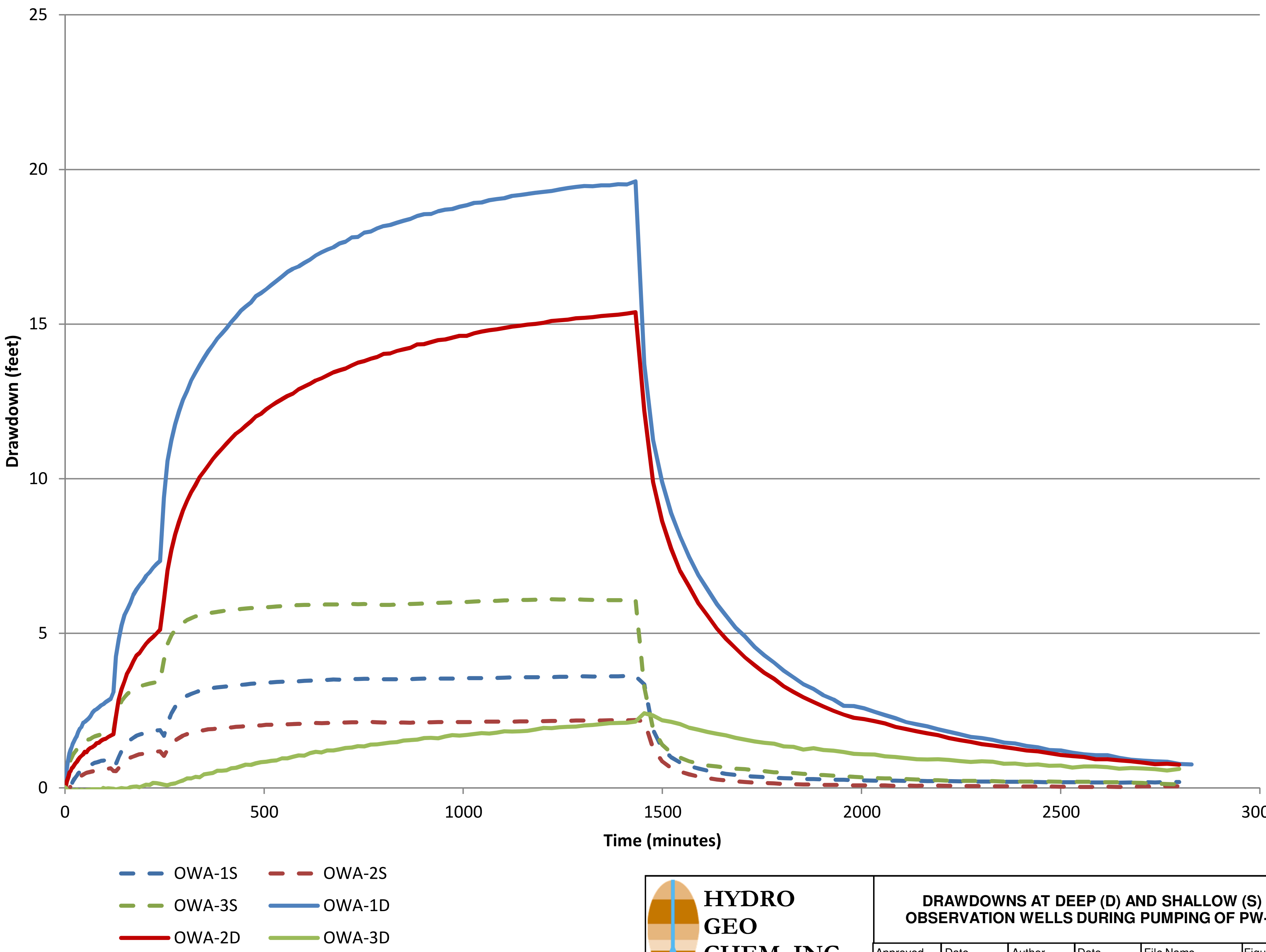


HYDRO GEO CHEM, INC.

RAW AND CORRECTED DRAWDOWNS AT WATER TABLE (BS) WELLS DURING PUMPING OF PW-B

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		4

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 4

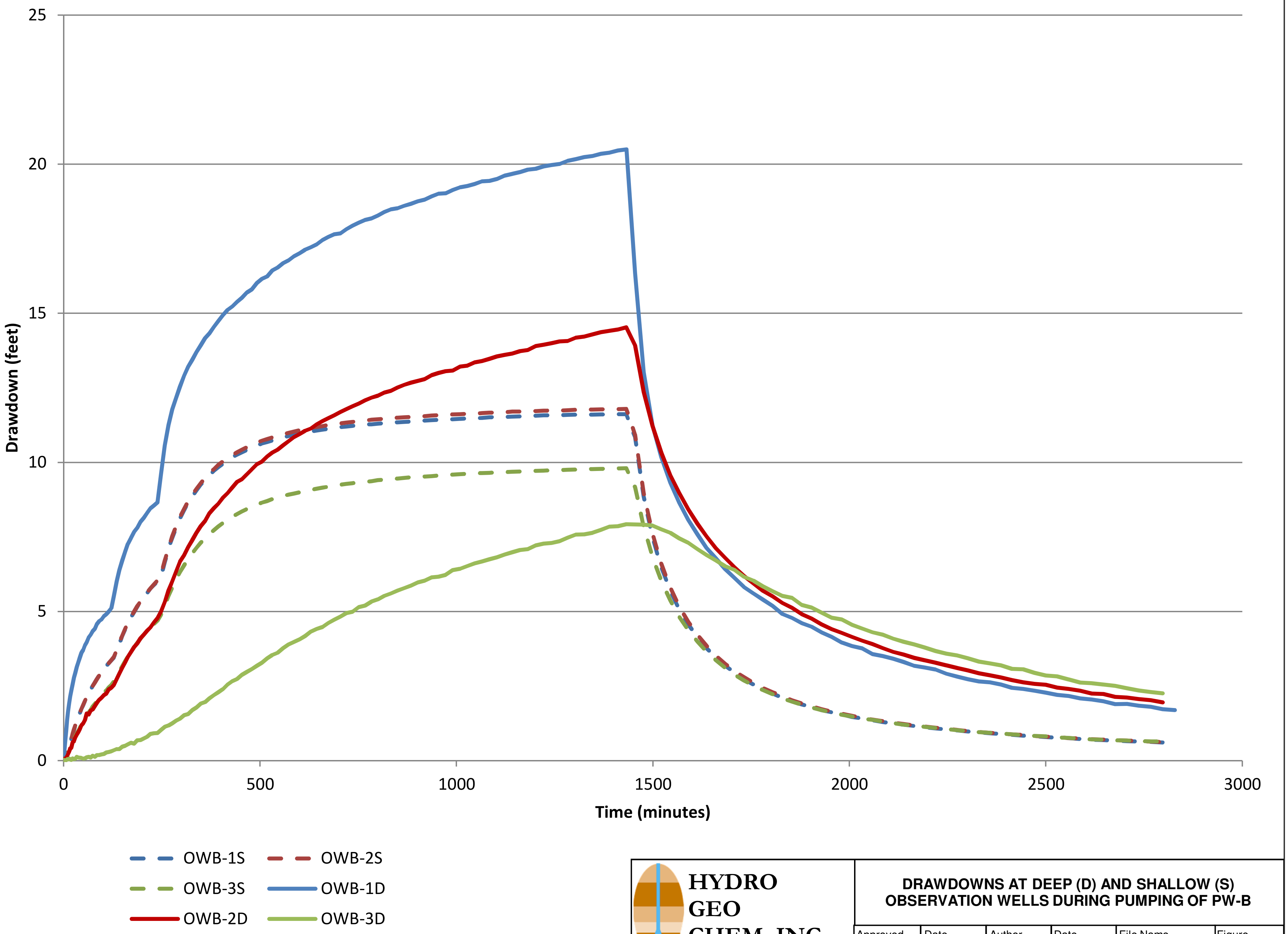


HYDRO GEO CHEM, INC.

DRAWDOWNS AT DEEP (D) AND SHALLOW (S) OBSERVATION WELLS DURING PUMPING OF PW-A

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		5

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 5

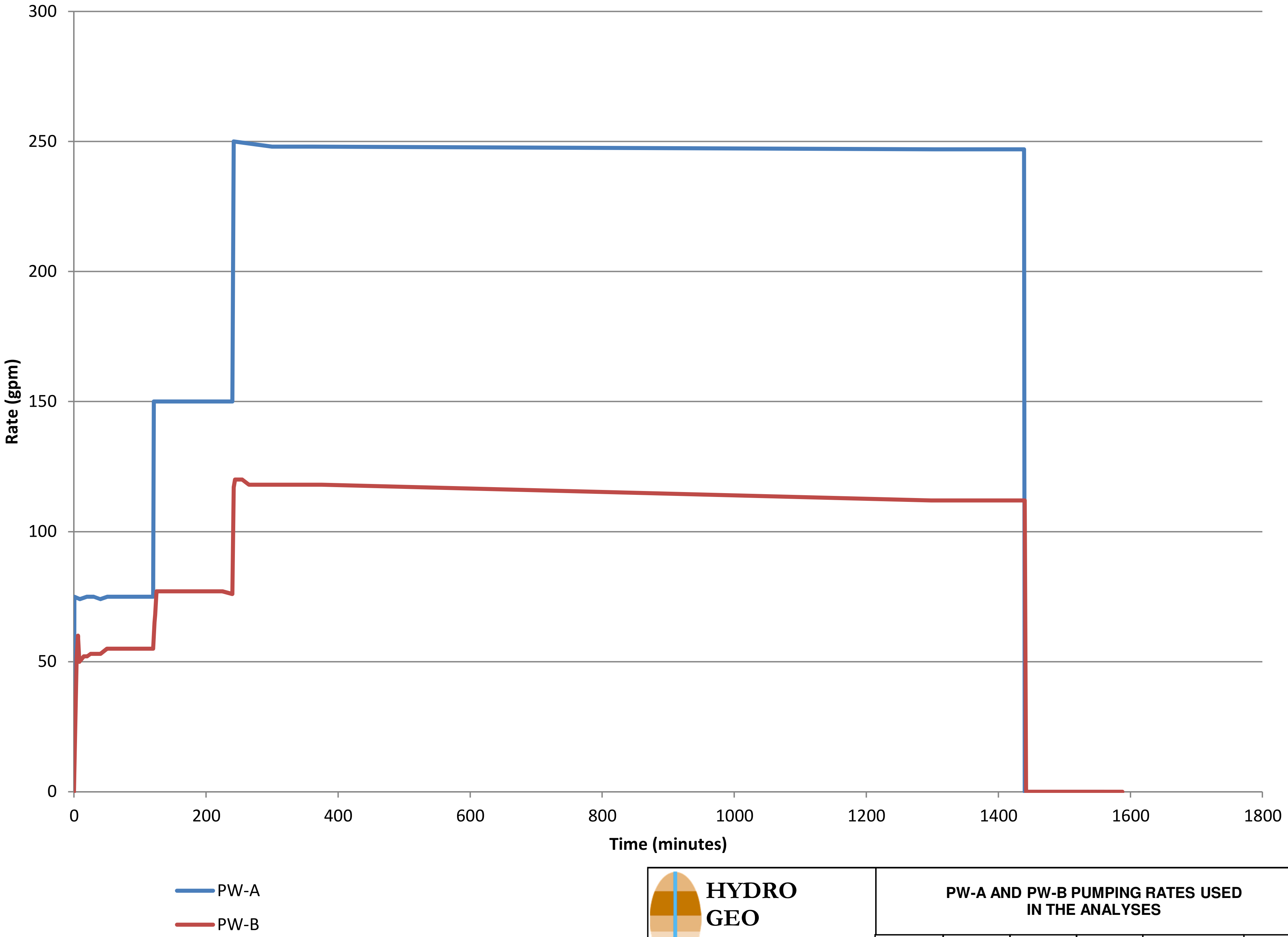


HYDRO GEO CHEM, INC.

DRAWDOWNS AT DEEP (D) AND SHALLOW (S) OBSERVATION WELLS DURING PUMPING OF PW-B

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		6

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 6



HYDRO
GEO
CHEM, INC.

PW-A AND PW-B PUMPING RATES USED IN THE ANALYSES

Approved	Date	Author	Date	File Name	Figure
SJS	4/16/19	SJS	4/16/19		7

H:\2018033.20 TTL Twin Pines Additional Reporting\Figures 1 thru 7.xlsx: Figure 7

APPENDIX A

OBSERVATION WELL LOCATIONS

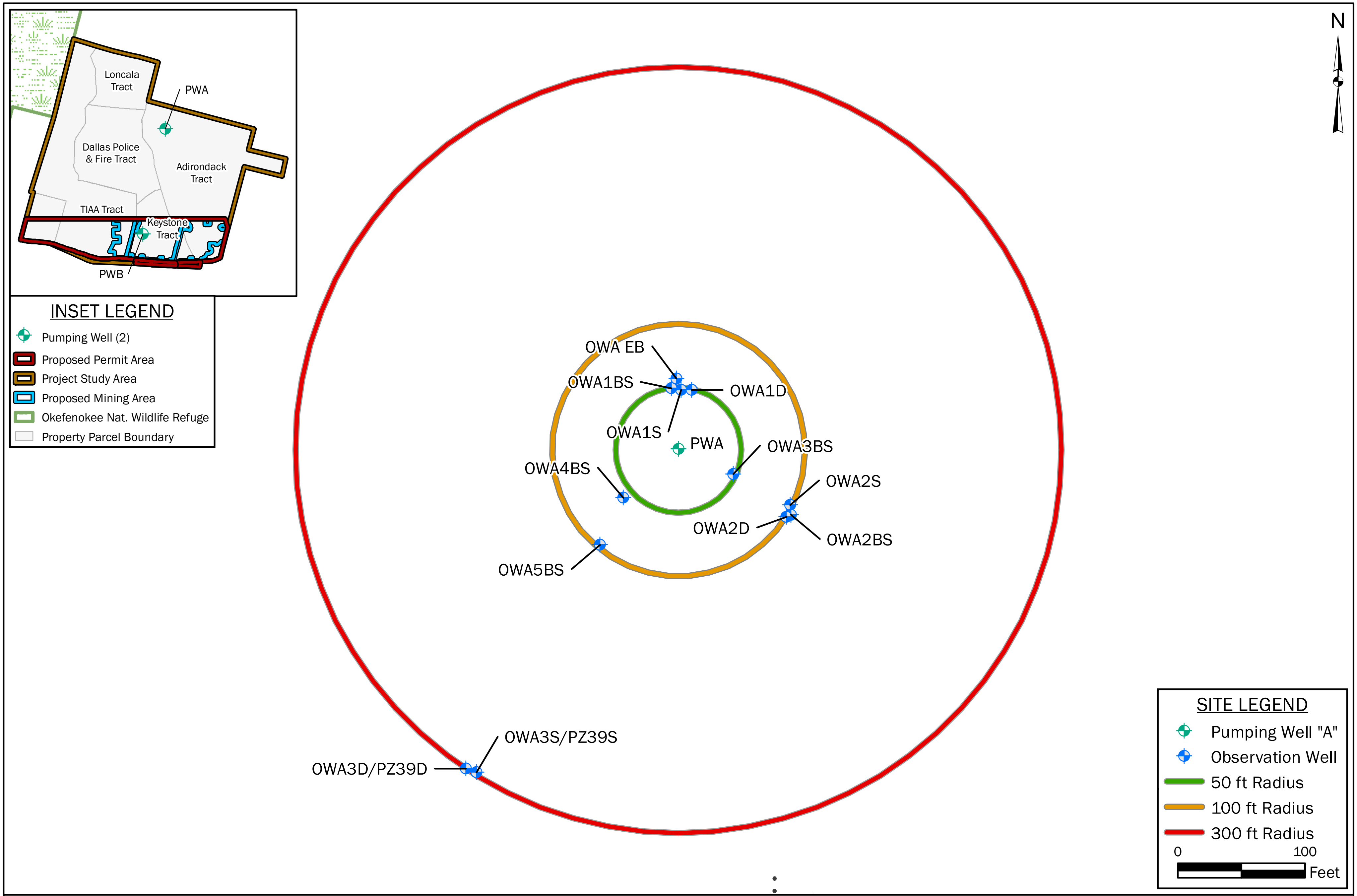
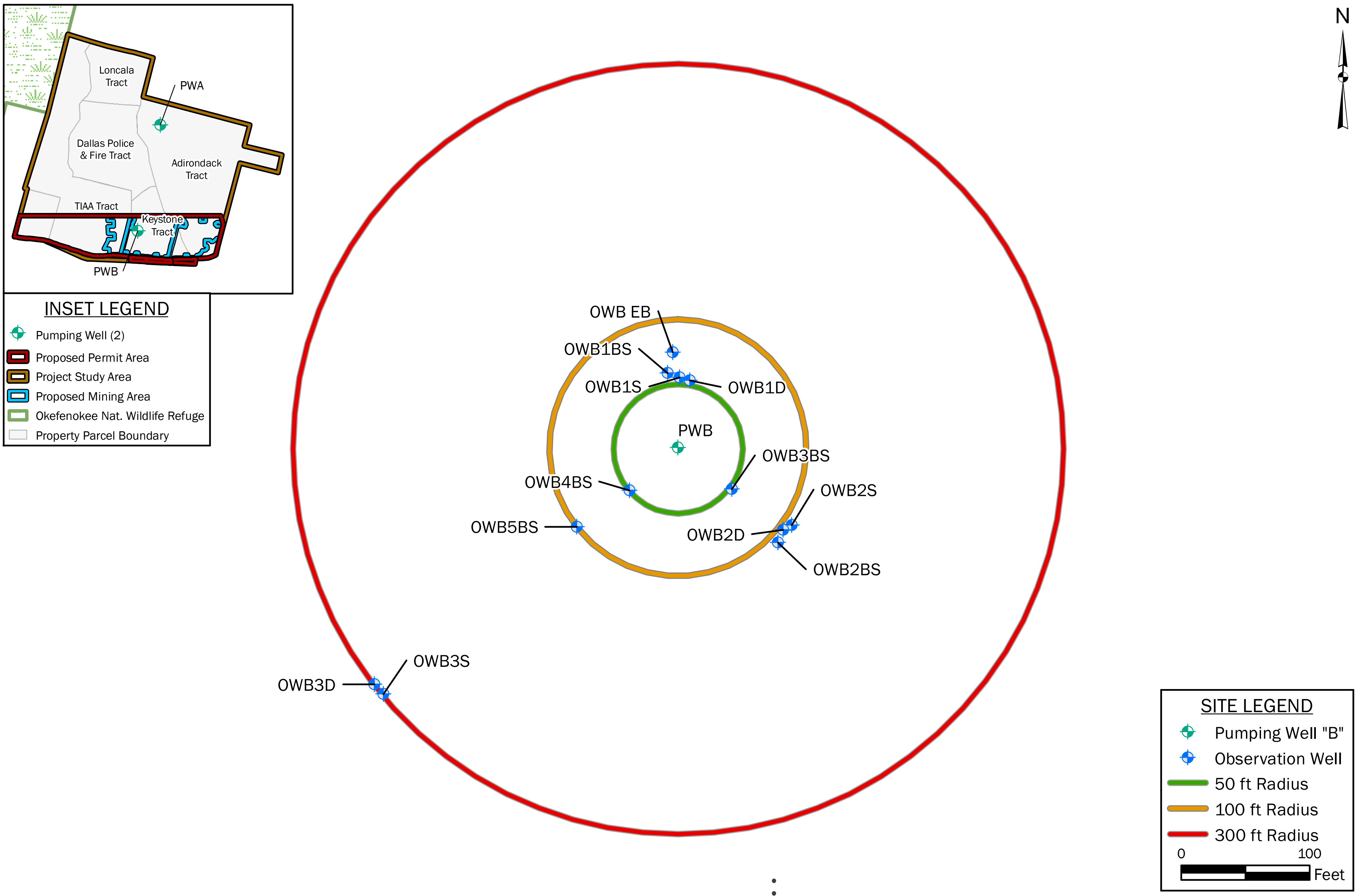


FIGURE: PUMPING WELL "A" LOCATION MAP

HYDROGEOLOGY OF THE TWIN PINES PROJECT AREA
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: DigitalGlobe, 3/24/2018.

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 9/27/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 100 ft



TTL

FIGURE: PUMPING WELL "B" LOCATION MAP

HYDROGEOLOGY OF THE TWIN PINES PROJECT AREA

TWIN PINES MINERALS

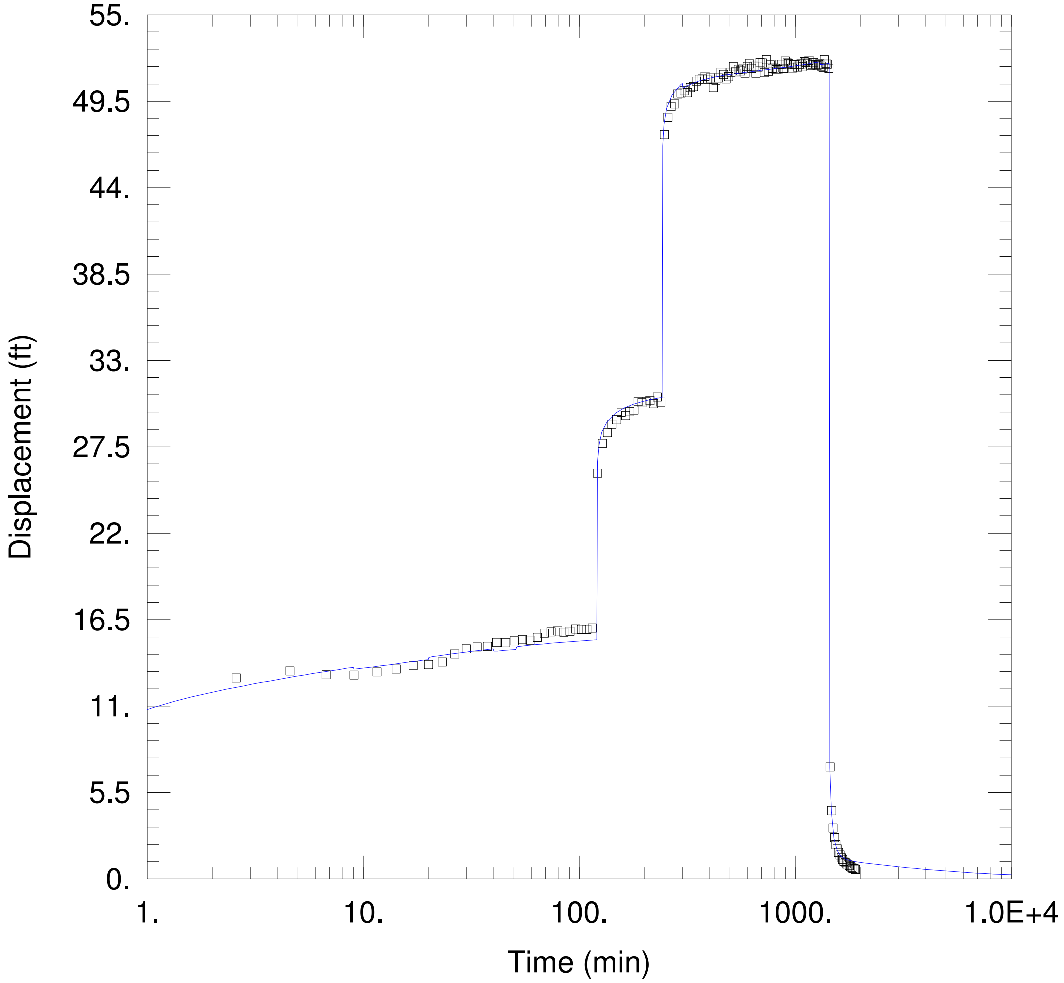
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: DigitalGlobe, 3/24/2018.

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 9/27/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 100 ft

APPENDIX B

AQTESOLV PWA TEST PLOTS



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA.aqt
Date: 03/28/19 Time: 15:40:35

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

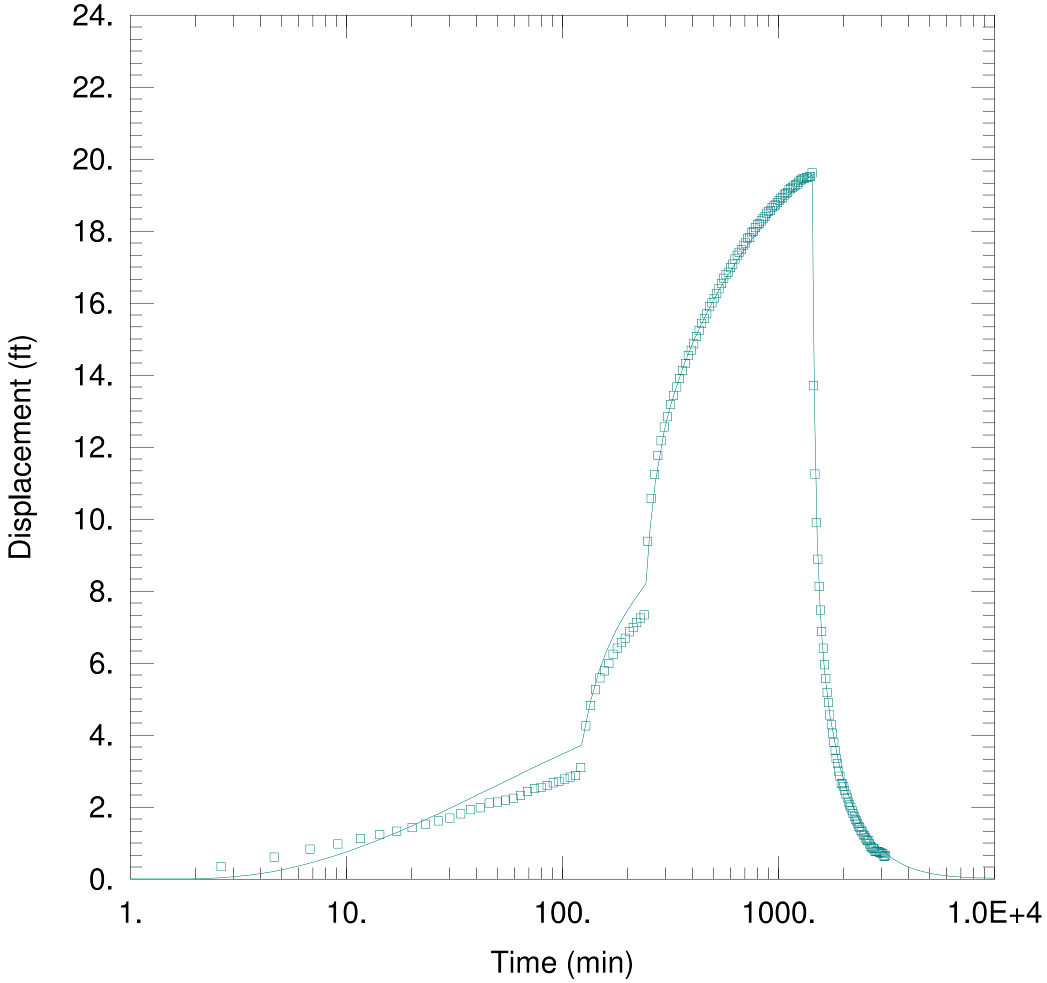
Observation Wells

Well Name	X (ft)	Y (ft)
□ PW-A	0	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1967.4 ft^2/day
S = 0.0003455
Sy = 0.002855
Kz/Kr = 0.01



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA1D.aqt
Date: 03/28/19 Time: 15:43:26

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50

SOLUTION

Aquifer Model: Unconfined

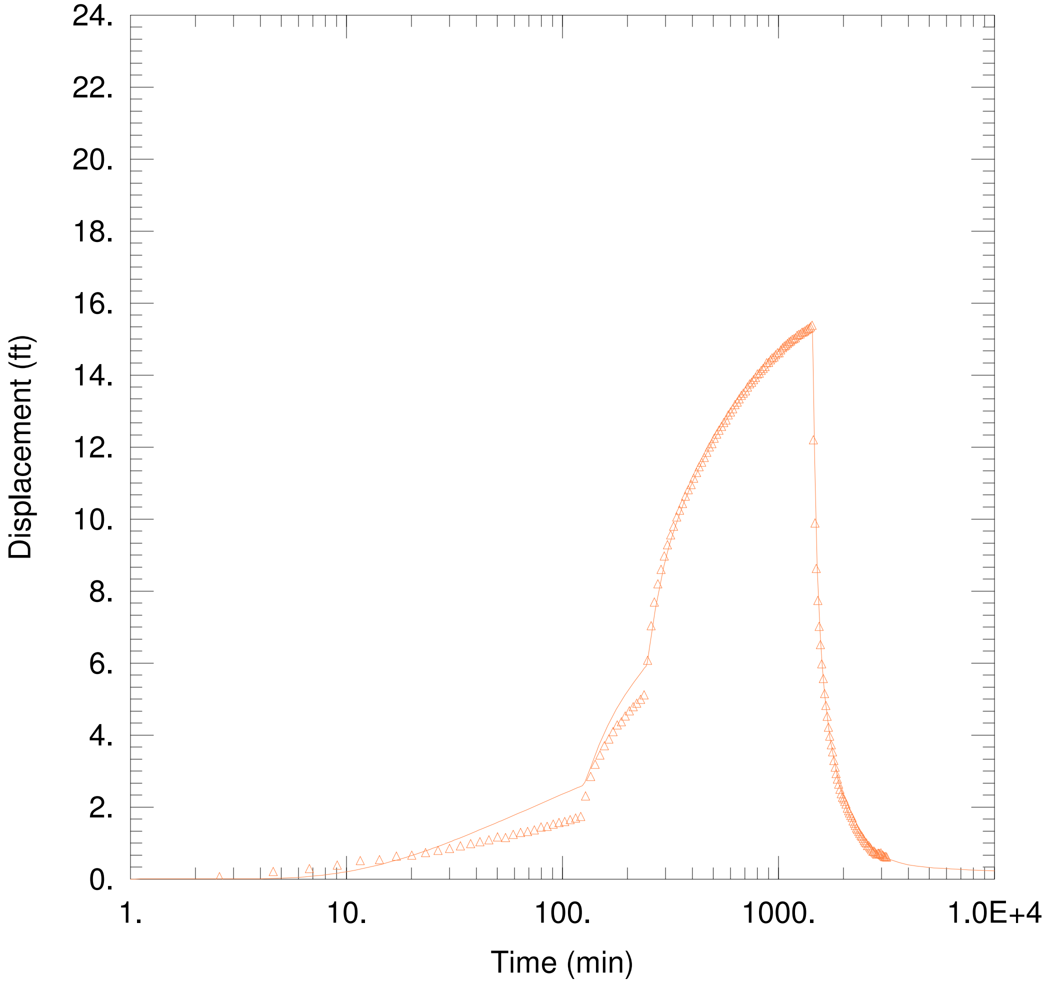
Solution Method: Neuman

T = 1475.1 ft^2/day

S = 0.008542

Sy = 0.5

Kz/Kr = 0.02302



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA2D.aqt
Date: 03/29/19 Time: 10:26:39

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

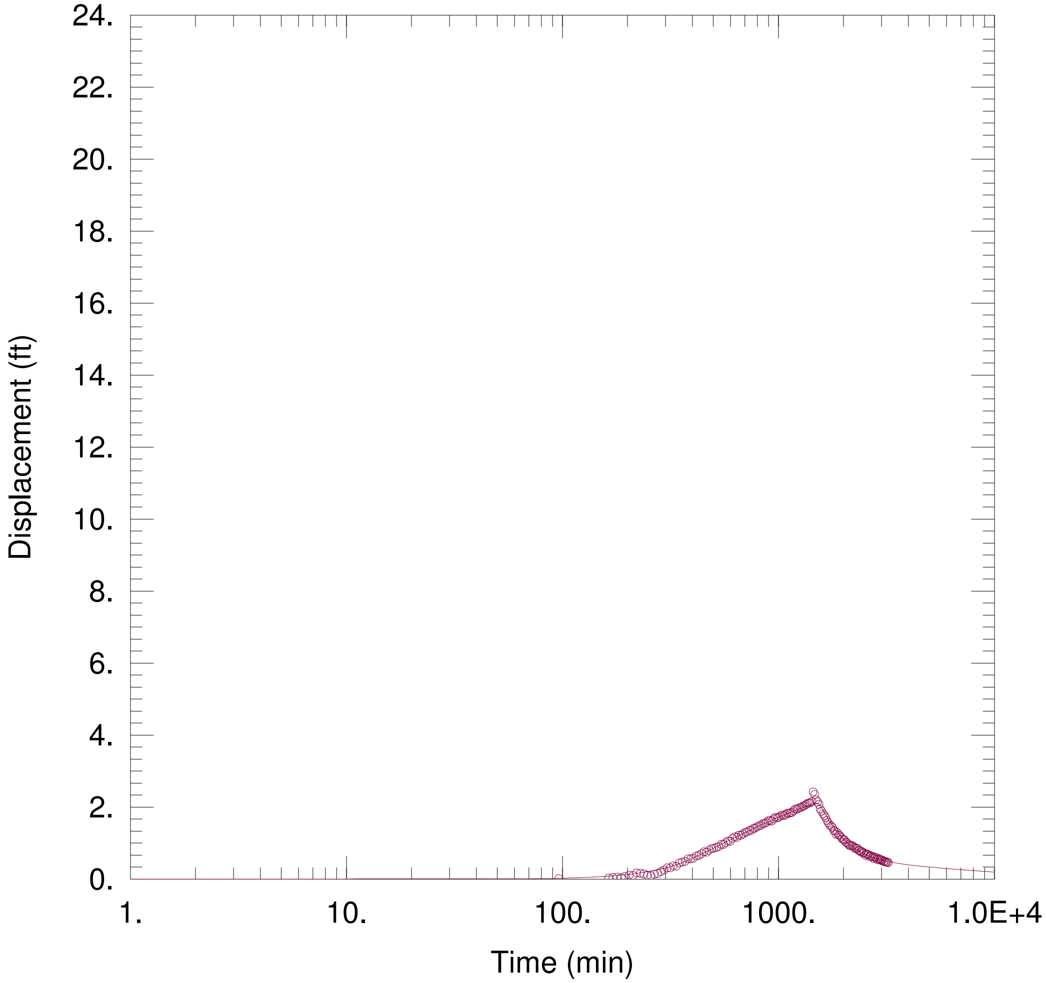
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1319.1 ft^2/day
S = 0.004789
Sy = 0.02874
Kz/Kr = 0.02569



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA3D.aqt
Date: 03/28/19 Time: 15:46:33

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

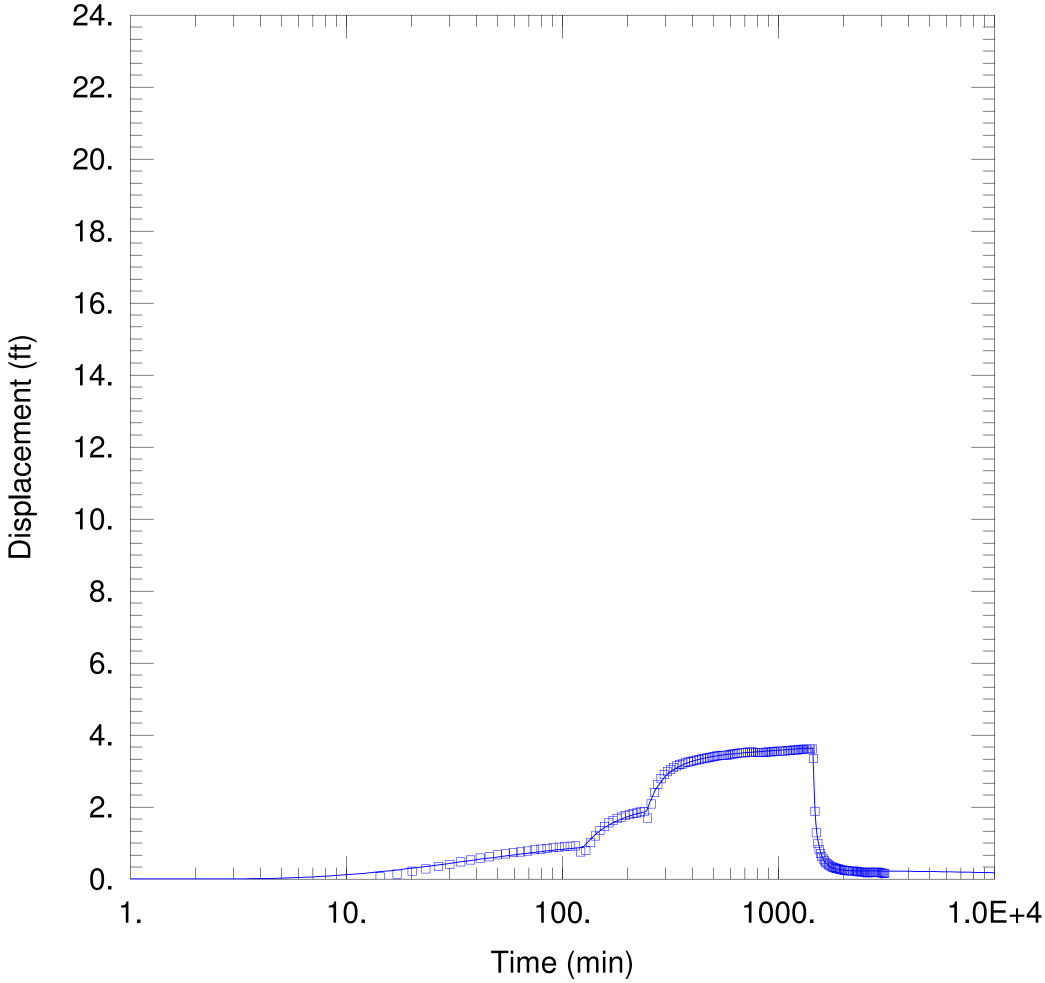
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWA3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2287.9 ft^2/day
S = 0.0166
Sy = 0.02589
Kz/Kr = 0.05415



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA1S.aqt
Date: 03/28/19 Time: 15:47:33

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

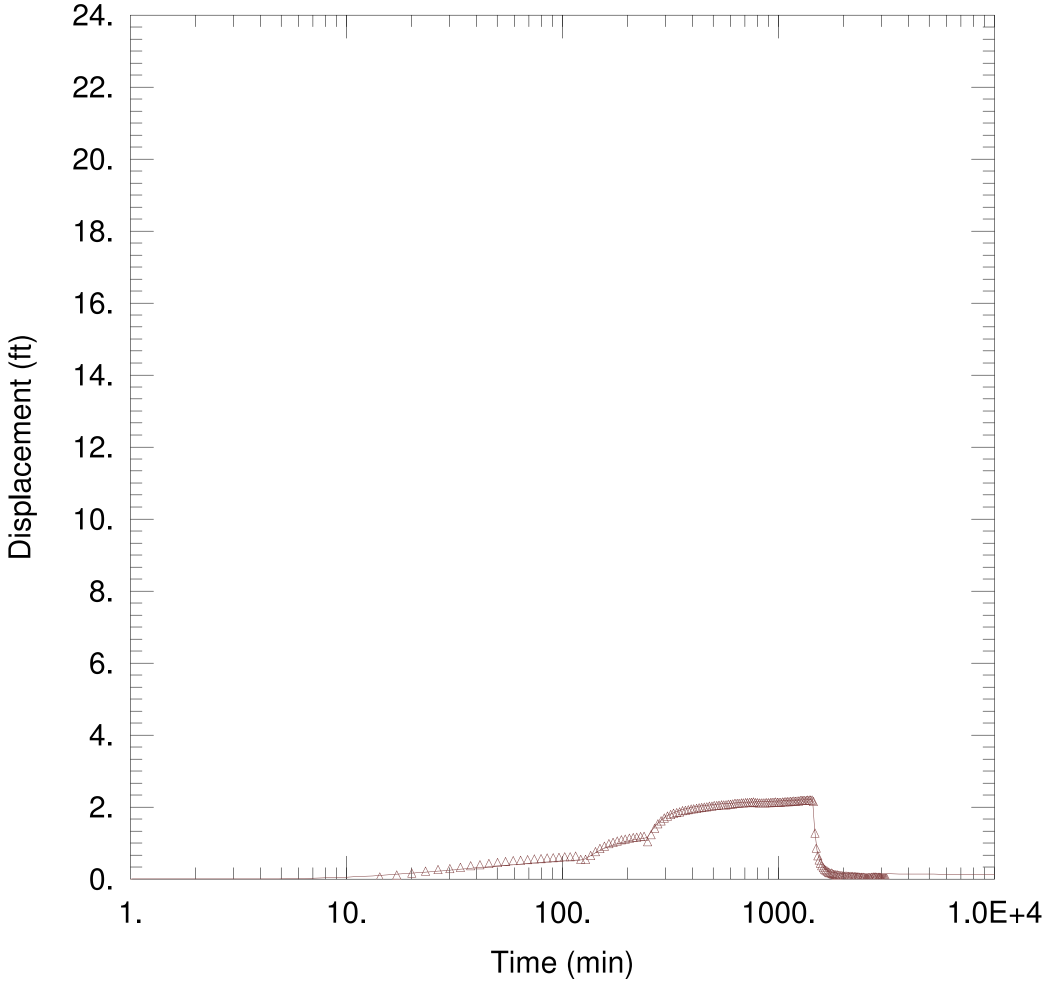
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1s	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1351.2 ft^2/day
S = 0.004255
Sy = 0.5
Kz/Kr = 0.1486



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA2S.aqt
Date: 03/28/19 Time: 15:48:11

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2s	0	100

SOLUTION

Aquifer Model: Unconfined

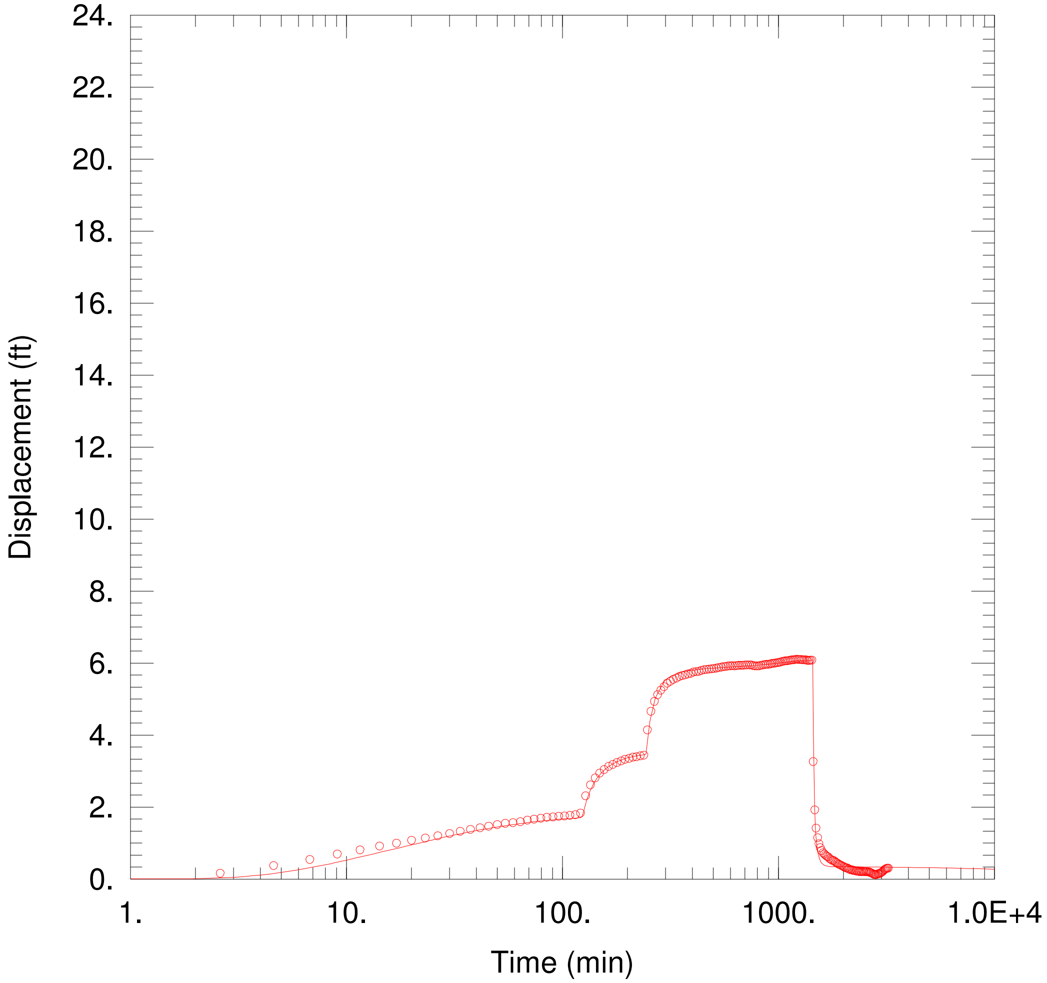
Solution Method: Neuman

T = 1820.3 ft^2/day

S = 0.00341

Sy = 0.5

Kz/Kr = 0.1034



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\1well\PWA_OWA3S.aqt
Date: 03/28/19 Time: 15:49:00

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

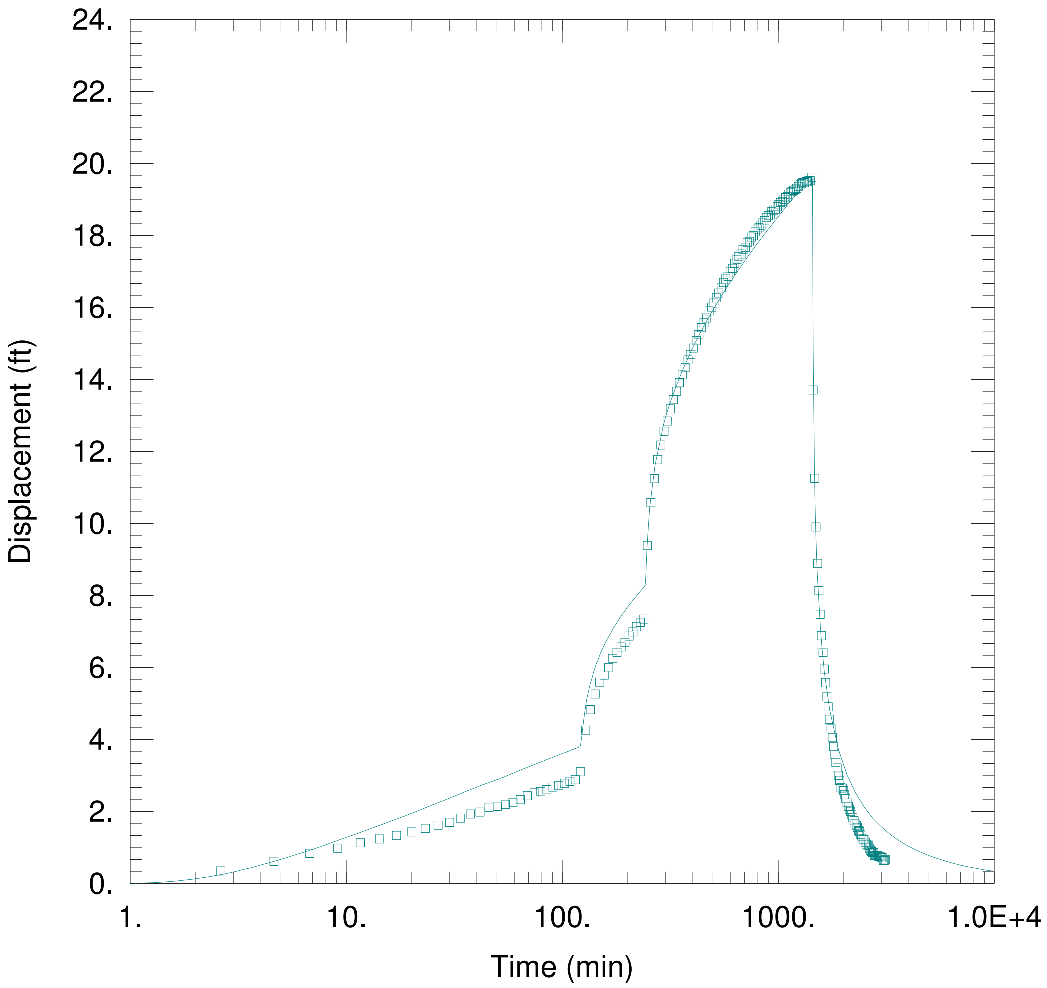
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWA3s	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 679.7 ft^2/day
S = 5.47E-5
Sy = 0.0216
Kz/Kr = 0.01



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob1d_NW.aqt
Date: 03/28/19 Time: 15:49:56

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b'): 10. ft
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

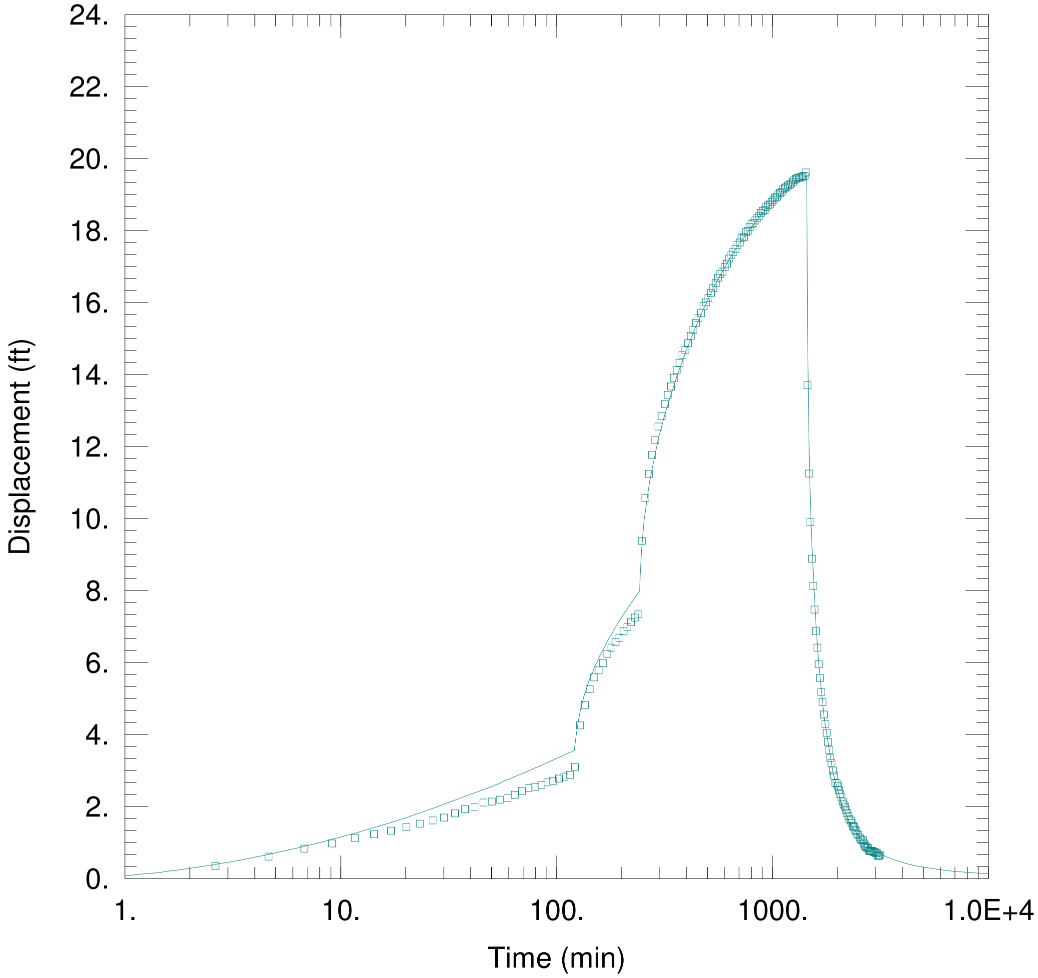
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 913.9 ft^2/day
S = 0.002234
1/B = 2.0E-5 ft^{-1}
ß/r = 0.0006577 ft^{-1}
T2 = 1.44E+8 ft^2/day
S2 = 1.0E-10



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob1d_NW_SJS.aqt
Date: 04/03/19
Time: 14:29:27

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

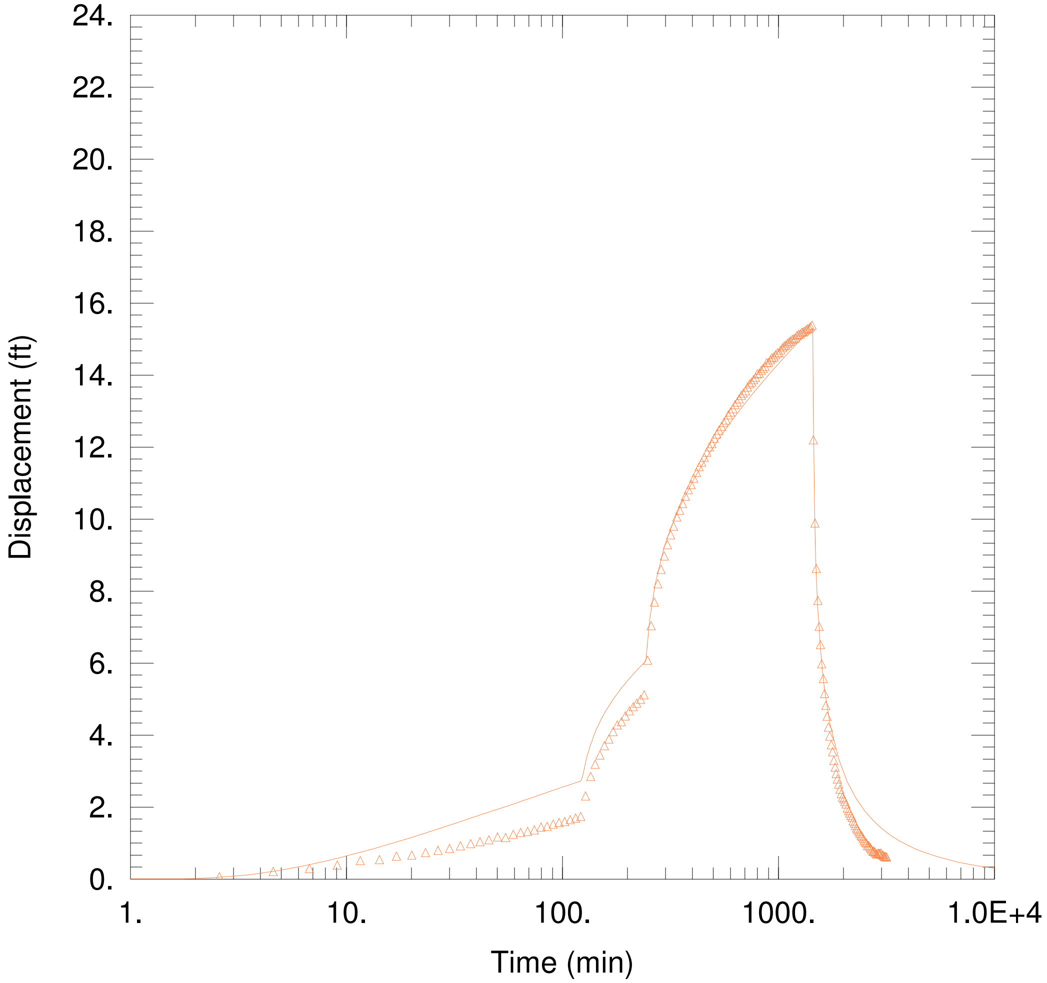
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 335.6 ft^2/day
1/B = 0.01145 ft^{-1}
T2 = 4169.6 ft^2/day
S = 7.303E-5
ß/r = 0.05652 ft^{-1}
S2 = 0.01494



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob2d_NW.aqt
Date: 03/29/19 Time: 10:30:08

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

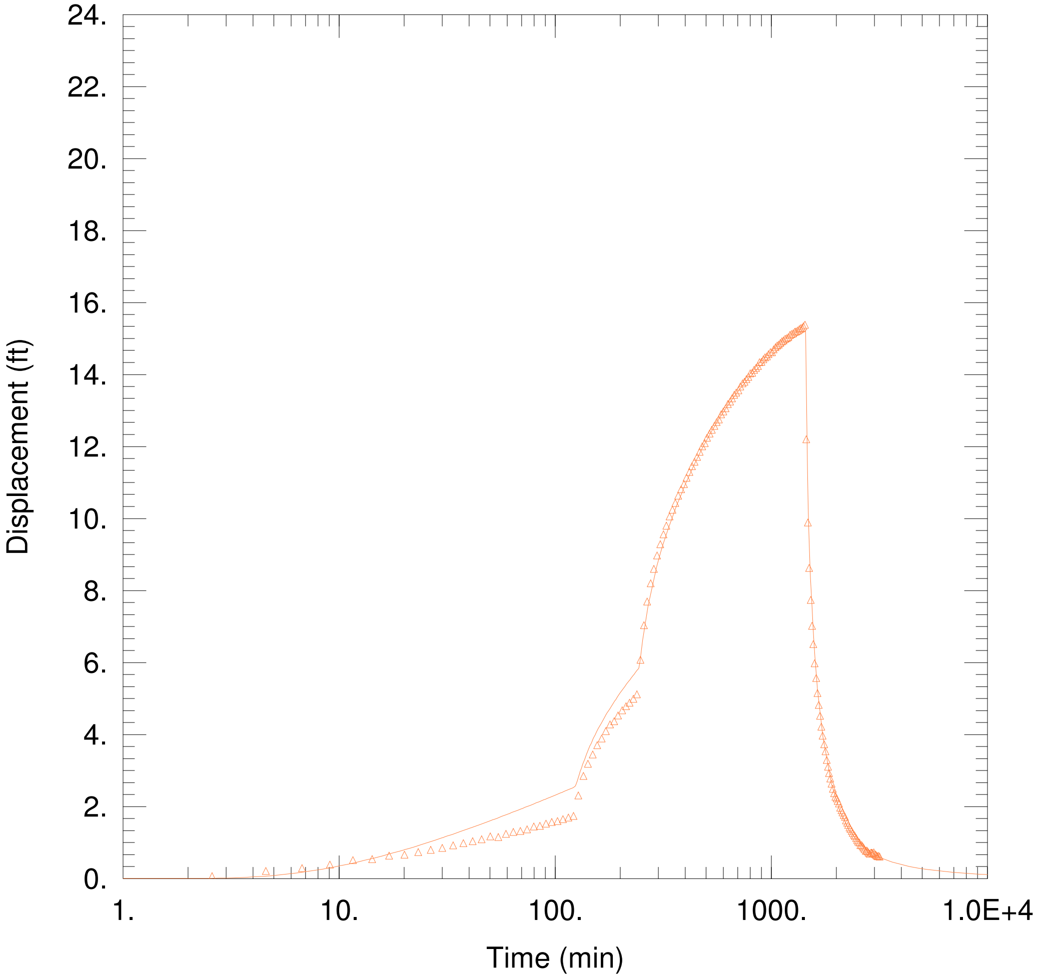
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2d	0	100

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 1016.8 ft^2/day
1/B = 2.0E-5 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.001197
ß/r = 0.0004419 ft^{-1}
S2 = 1.0E-10



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob2d_NW_SJS.aqt
Date: 04/03/19 Time: 14:30:03

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

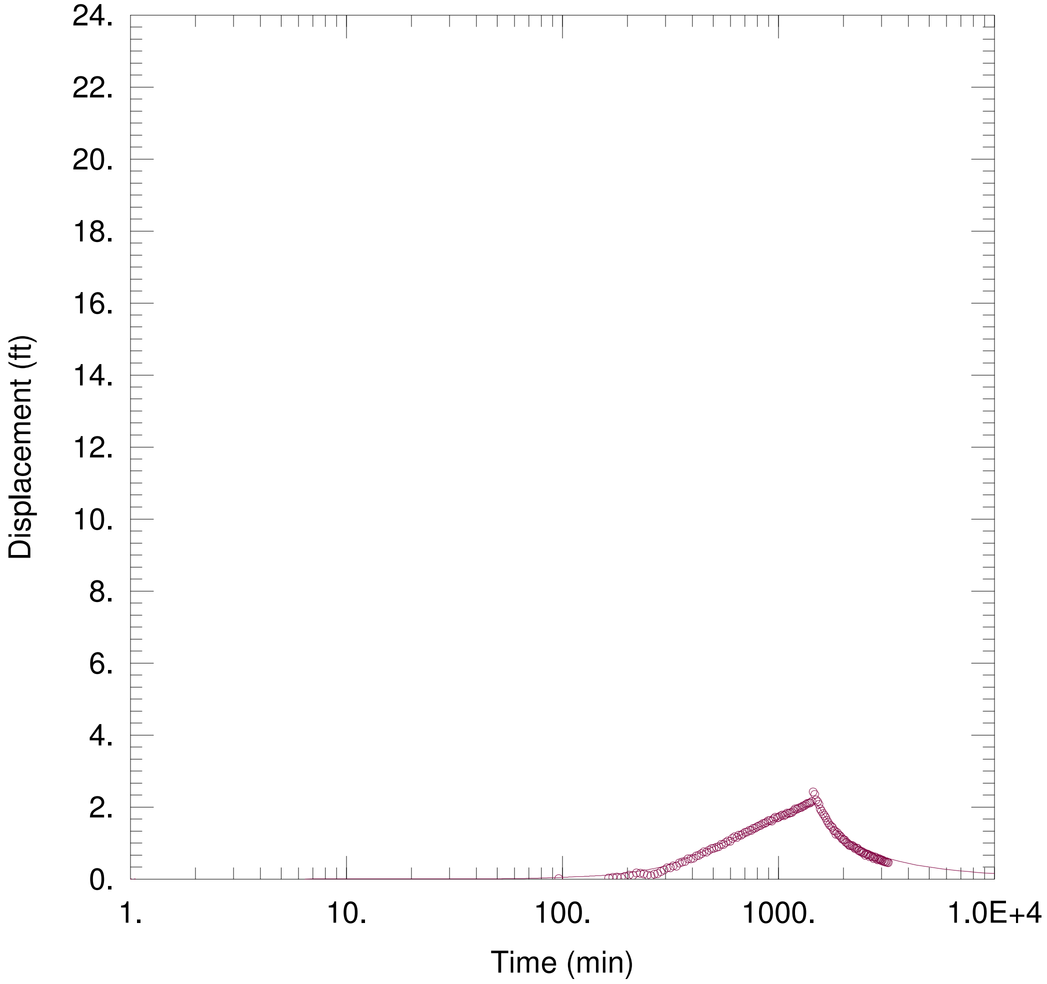
Well Name	X (ft)	Y (ft)
△ OWA2d	0	100

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 421.8 ft^2/day
1/B = 0.006006 ft^{-1}
T2 = 4850.3 ft^2/day

S = 0.0008812
ß/r = 0.004494 ft^{-1}
S2 = 1.014E-10



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob3d_NW.aqt
Date: 03/28/19 Time: 15:54:54

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

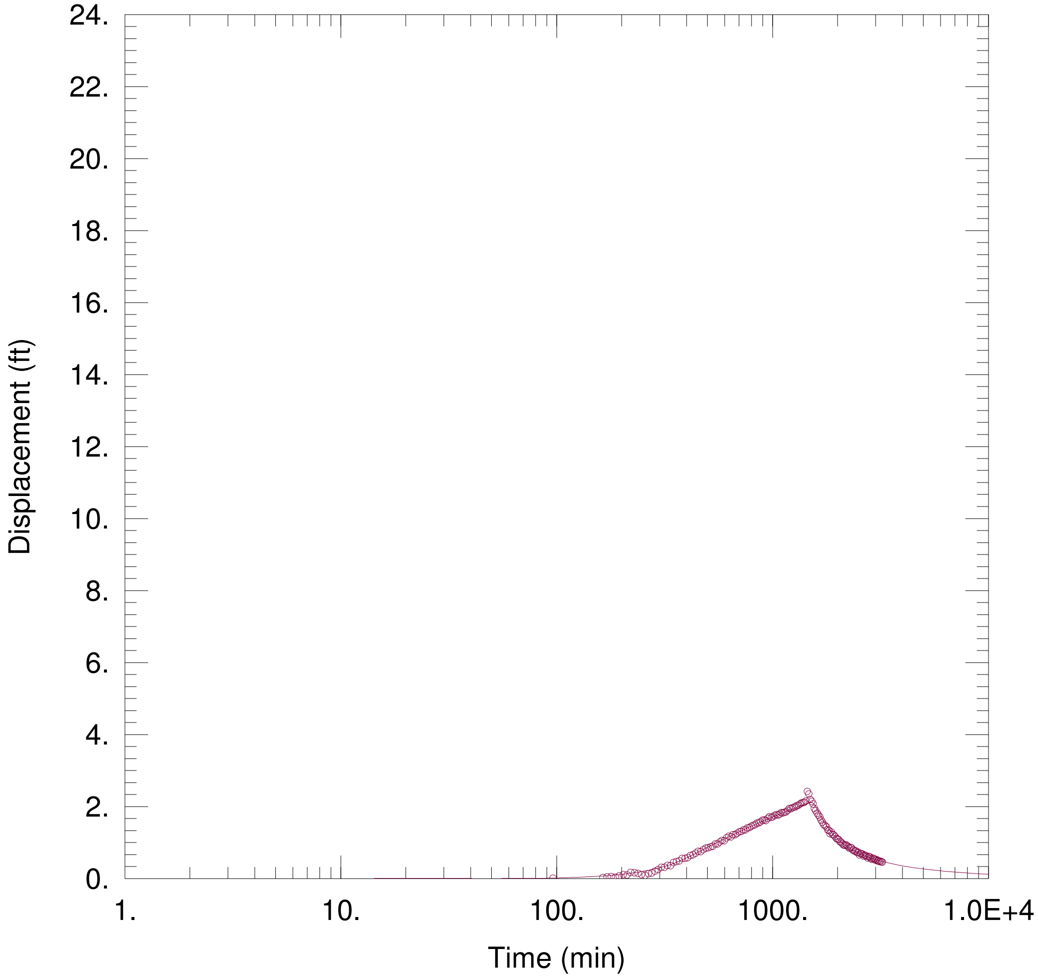
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWA3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 1700. ft^2/day
1/B = 2.0E-5 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.006985
ß/r = 0.0009901 ft^{-1}
S2 = 2.666E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob3d_NW_SJS.aqt
Date: 04/03/19 Time: 14:31:00

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b'): 10. ft
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

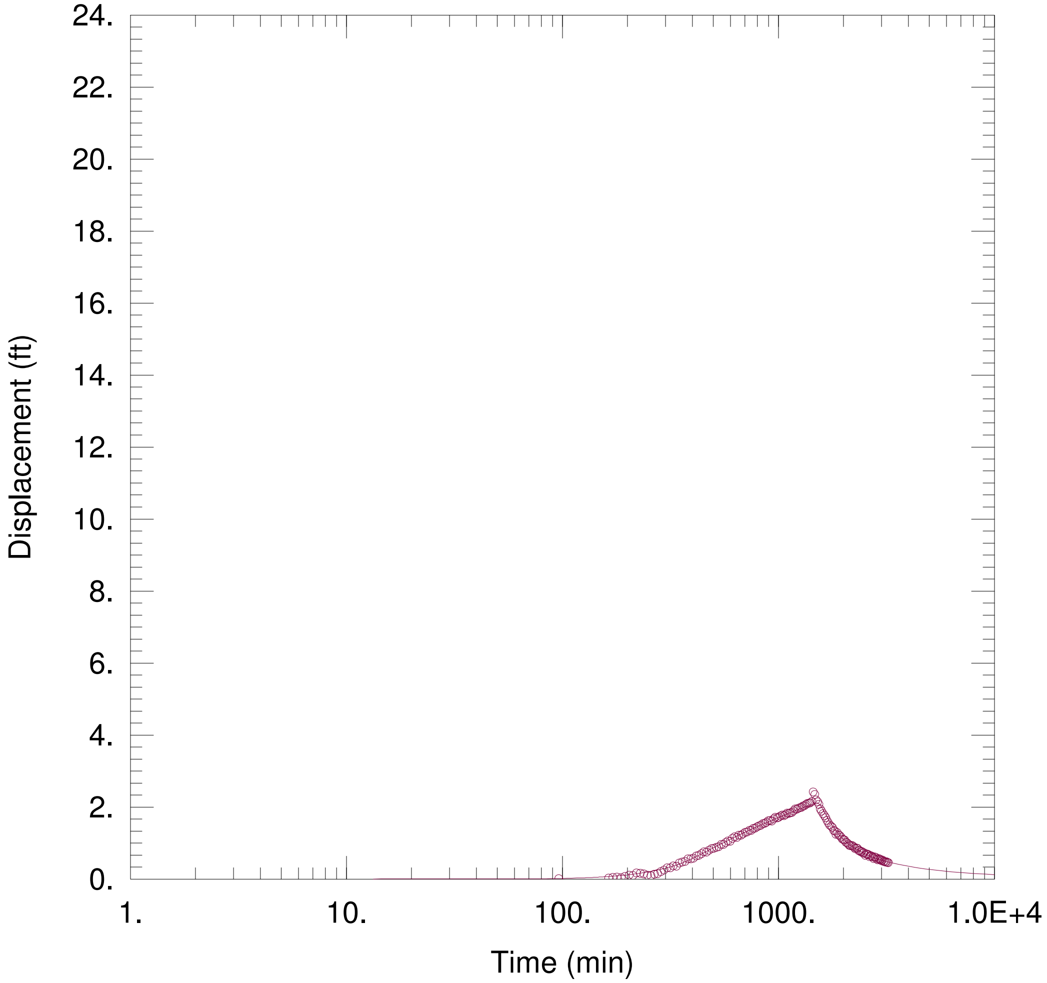
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWA3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 331.1 ft^2/day
S = 0.003357
1/B = 0.01076 ft^{-1}
ß/r = 0.001353 ft^{-1}
T2 = 4271.6 ft^2/day
S2 = 0.009912



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob3d_NW2.aqt
Date: 03/29/19 Time: 09:28:41

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

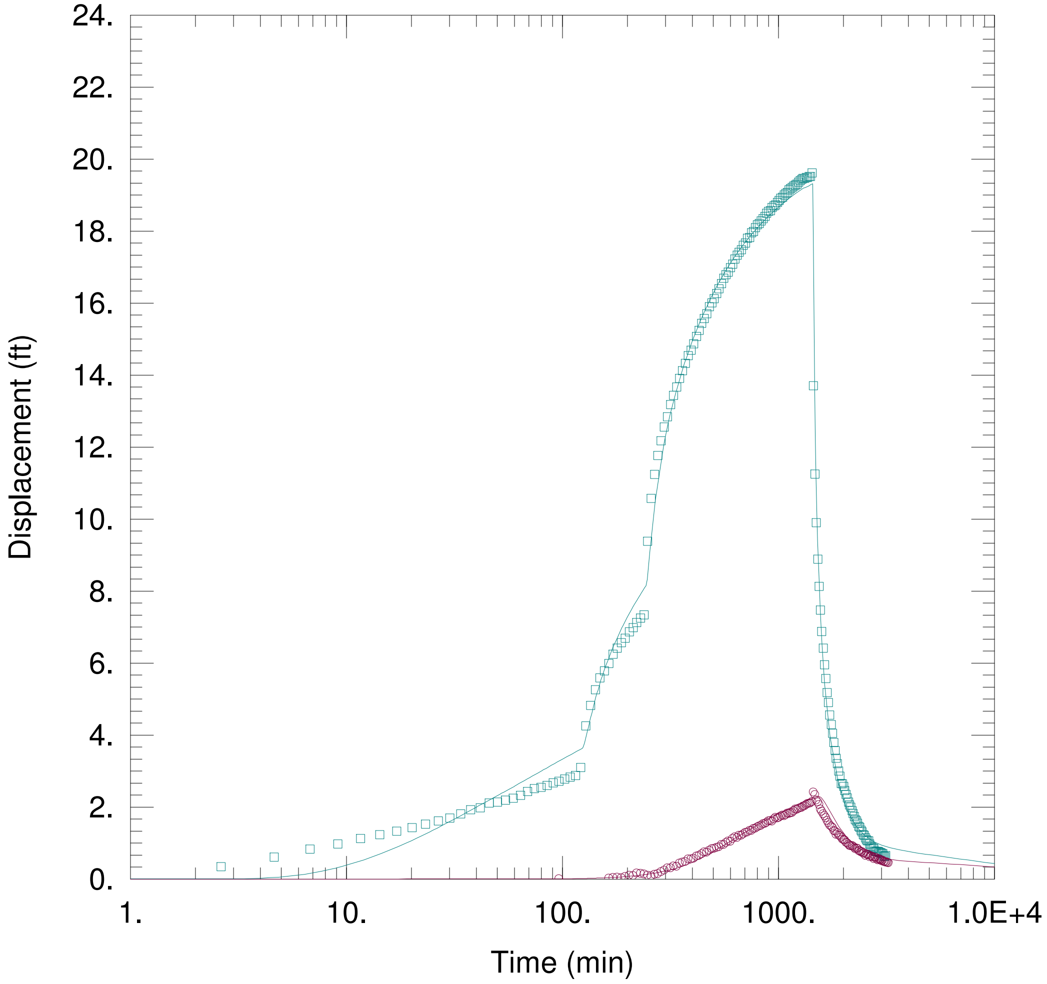
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWA3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 1.257 ft^2/day
1/B = 0.1775 ft^{-1}
T2 = 4520.2 ft^2/day
S = 0.0001038
ß/r = 0.2512 ft^{-1}
S2 = 0.004708



WELL TEST ANALYSIS

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Date: 03/29/19 Time: 09:29:52

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

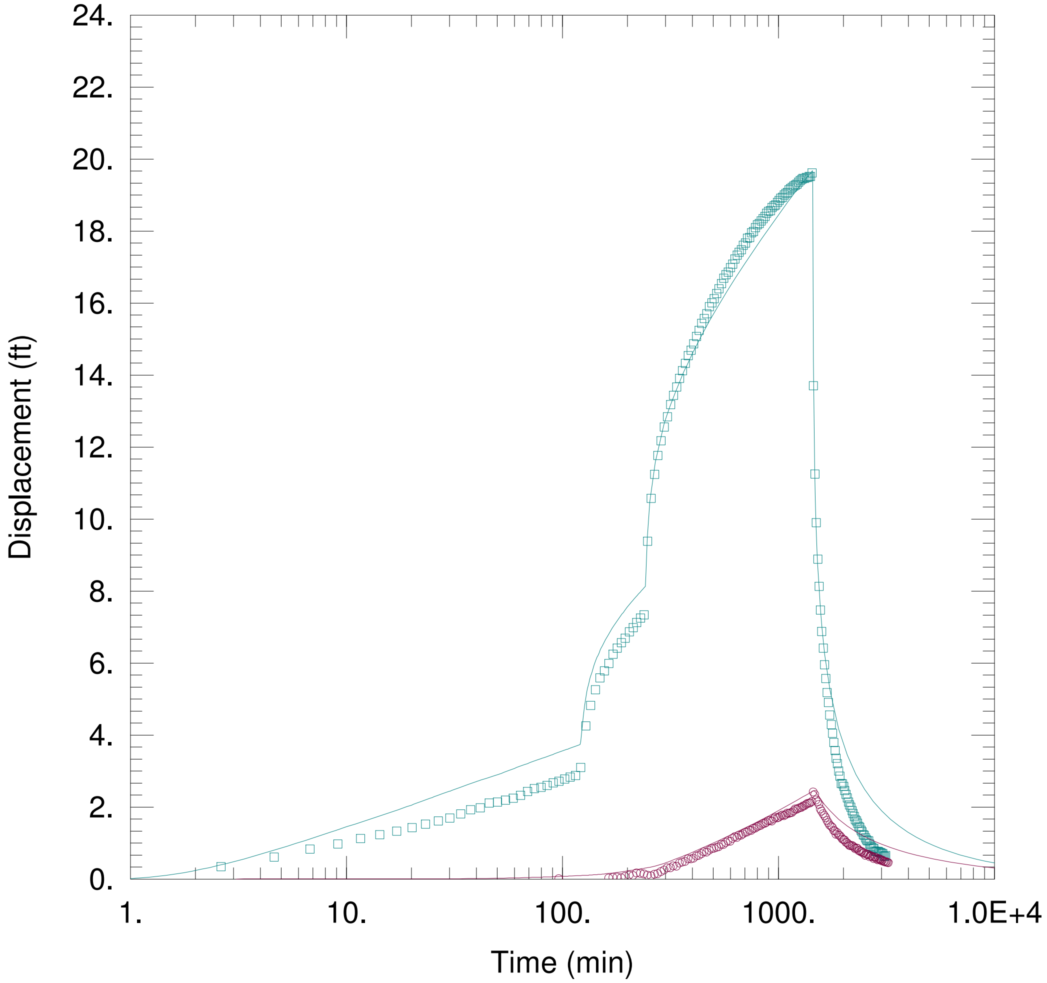
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50
○ OWA3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 946.2 ft^2/day
S = 0.01174
Sy = 0.05878
Kz/Kr = 0.1548



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob1d_3d_NW.aqt
Date: 03/28/19 Time: 16:20:31

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

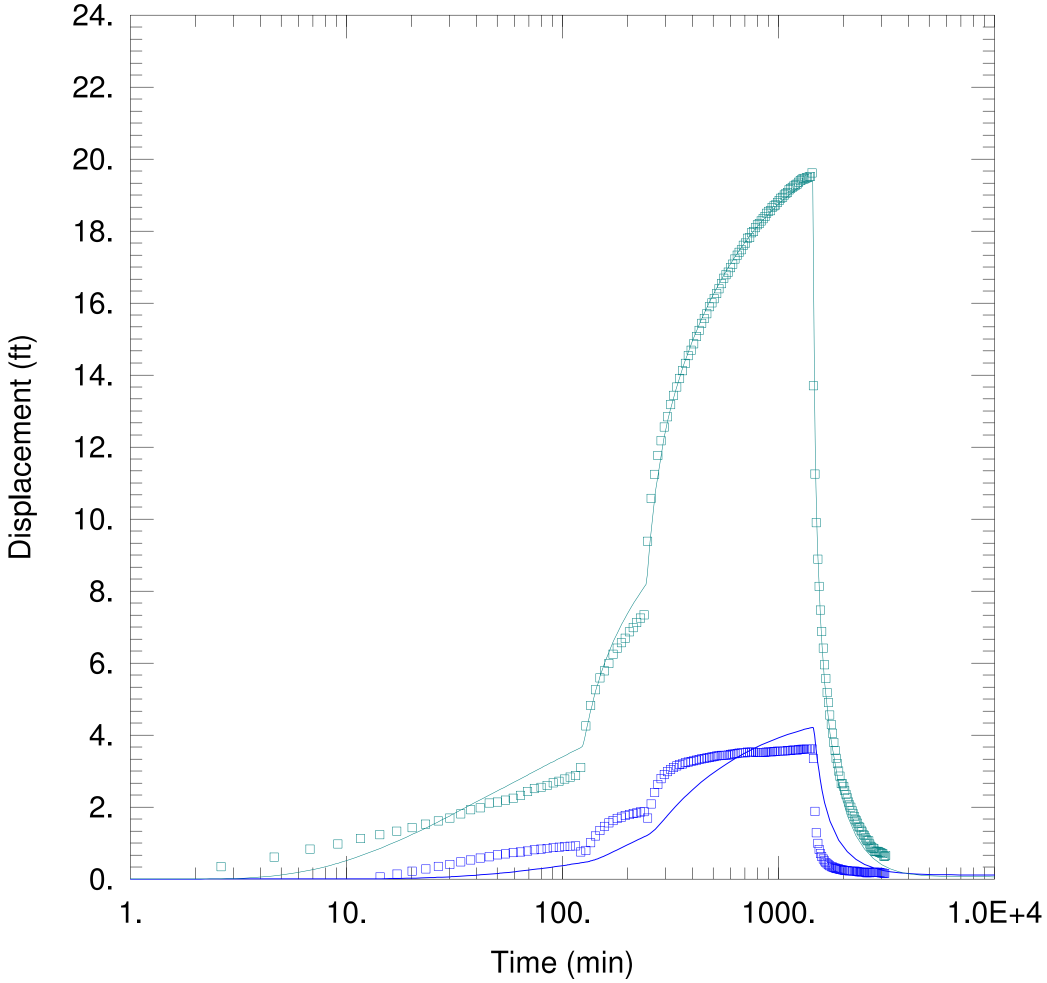
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50
○ OWA3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 595.9 ft^2/day
1/B = 2.0E-5 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.0009761
ß/r = 0.005853 ft^{-1}
S2 = 1.0E-10



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA1.aqt
Date: 03/29/19 Time: 09:31:03

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

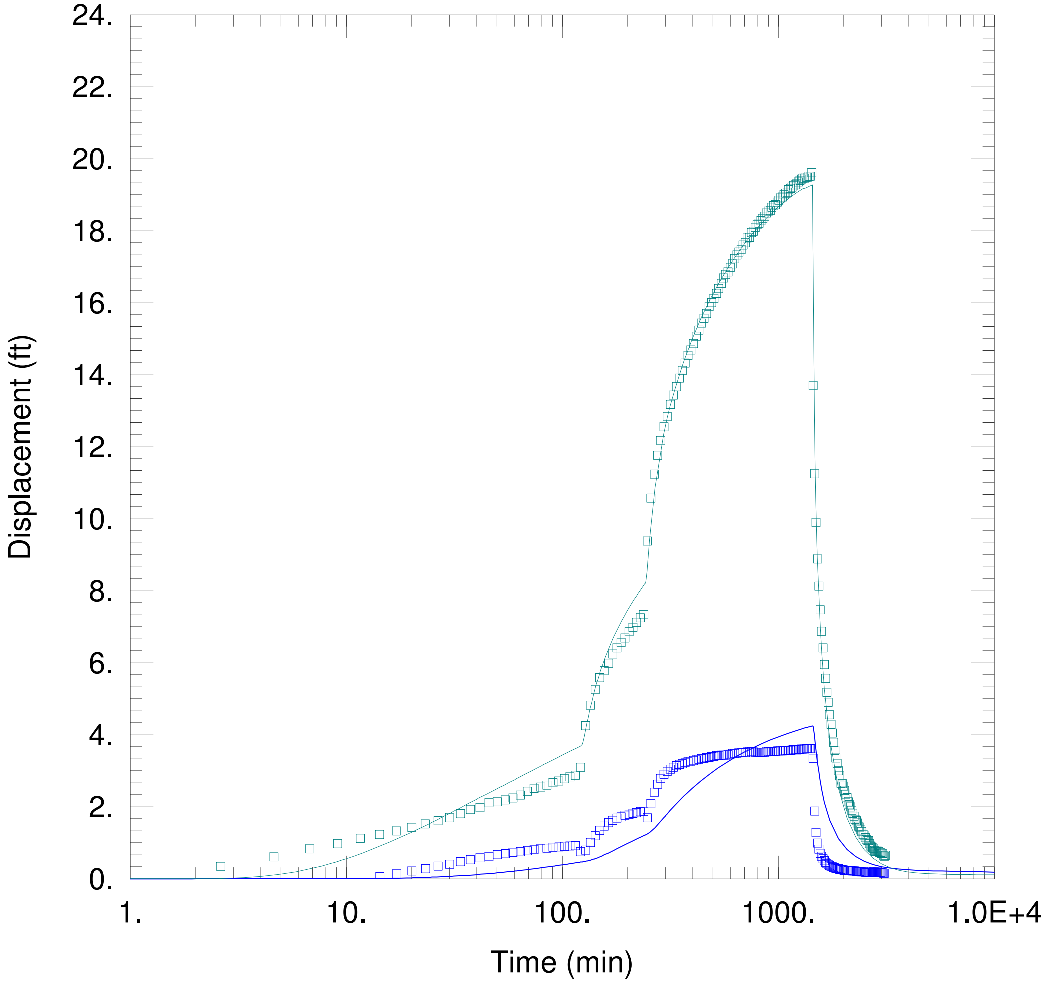
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1s	0	50
□ OWA1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1136.1 ft^2/day
S = 0.01072
Sy = 0.5
Kz/Kr = 0.07644



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA1_2.aqt
Date: 03/28/19 Time: 16:22:24

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

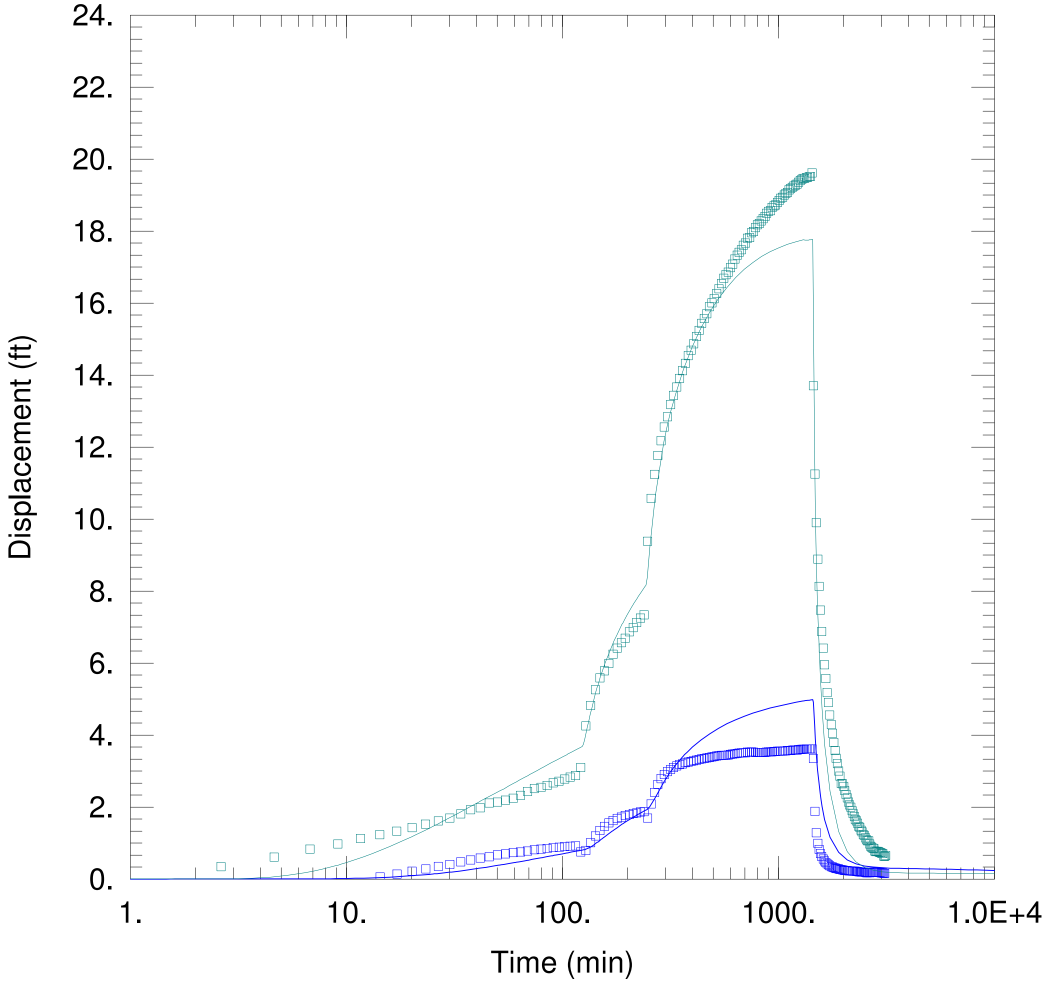
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1s	0	50
□ OWA1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1153.6 ft^2/day
S = 0.01019
Sy = 0.25
Kz/Kr = 0.07527



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA1_et.aqt
Date: 03/28/19 Time: 16:23:49

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

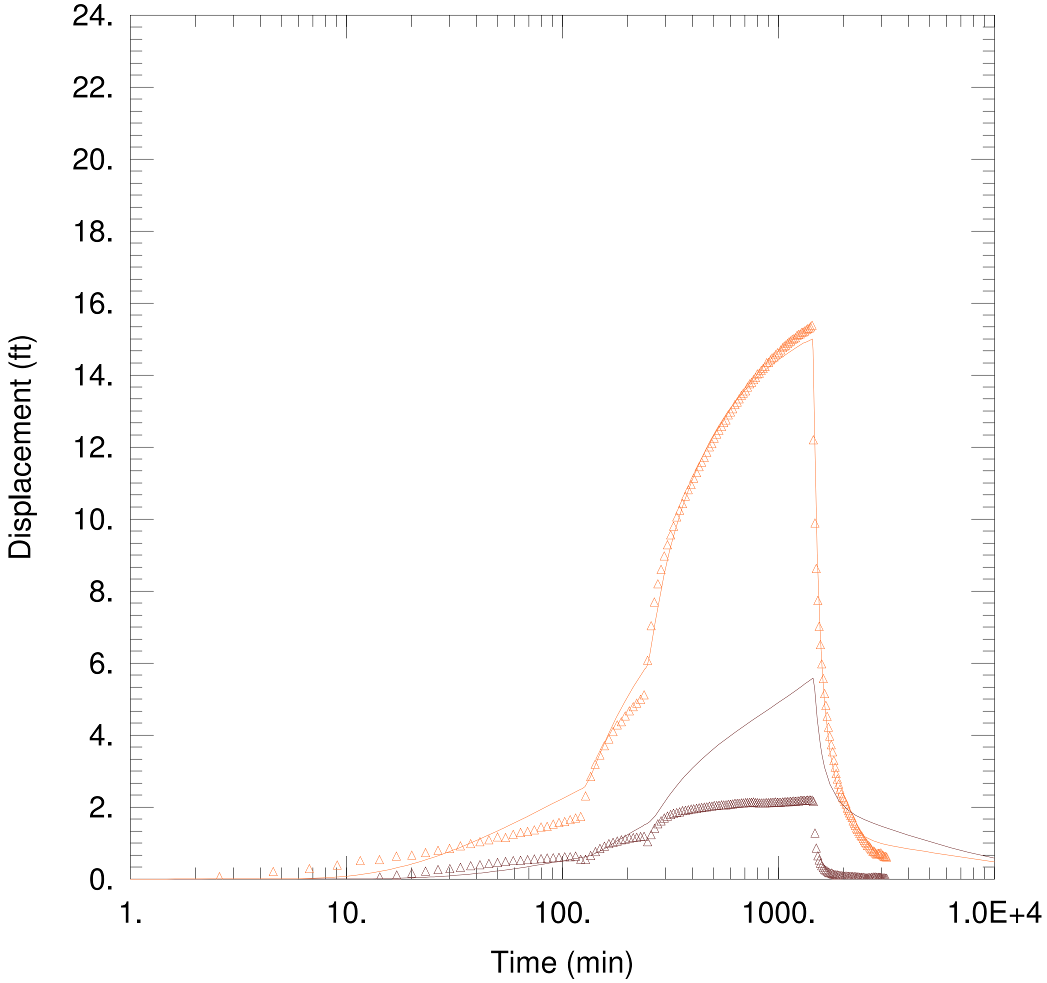
Well Name	X (ft)	Y (ft)
□ OWA1s	0	50
□ OWA1d	0	50

SOLUTION

Aquifer Model: Unconfined Solution Method: Neuman

T = 925.9 ft^2/day
Sy = 0.5

S = 0.01046
Kz/Kr = 0.2029



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA2.aqt
Date: 03/29/19 Time: 09:54:11

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

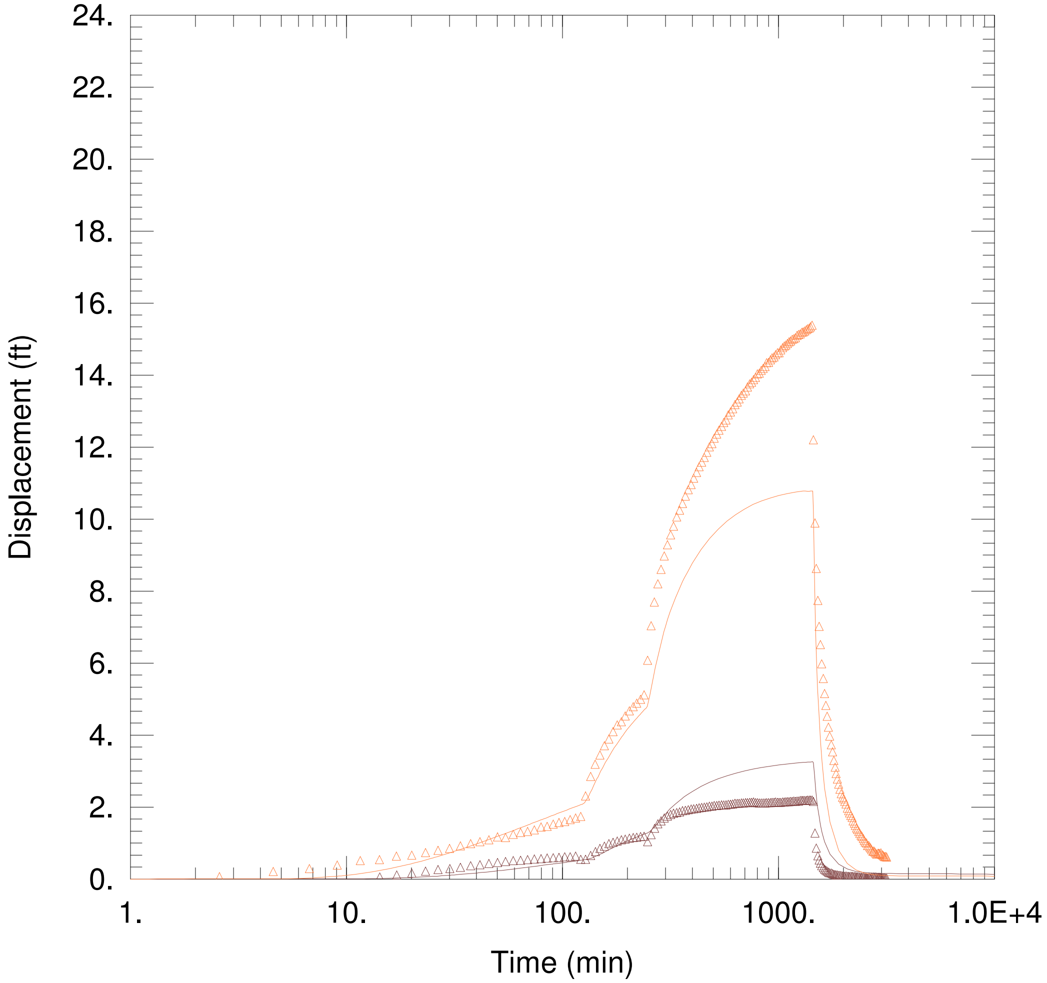
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2s	0	100
△ OWA2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 865.7 ft^2/day
S = 0.005311
Sy = 0.03262
Kz/Kr = 0.1



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA2_et.aqt
Date: 03/28/19 Time: 16:26:45

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

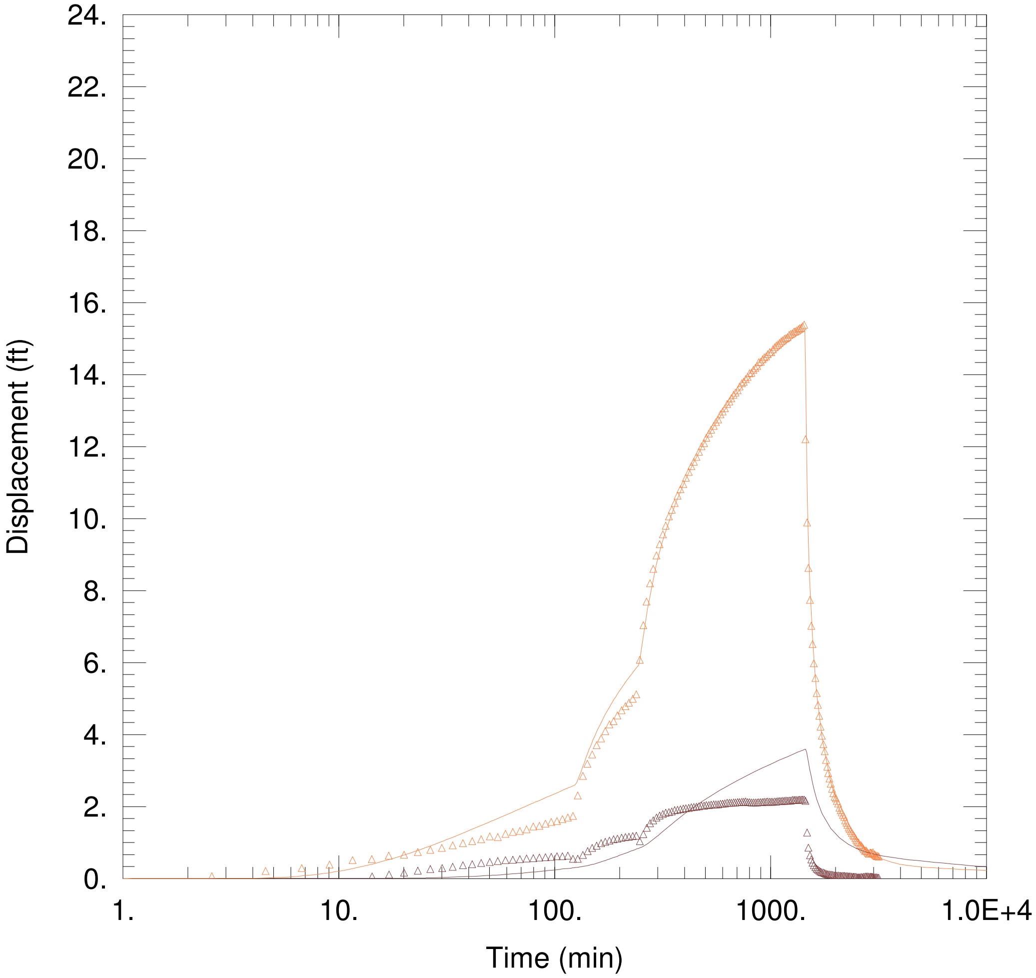
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2s	0	100
△ OWA2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1141.4 ft^2/day
S = 0.005758
Sy = 0.5
Kz/Kr = 0.1057



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA2_SJS.aqt
Date: 04/03/19 Time: 14:32:11

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

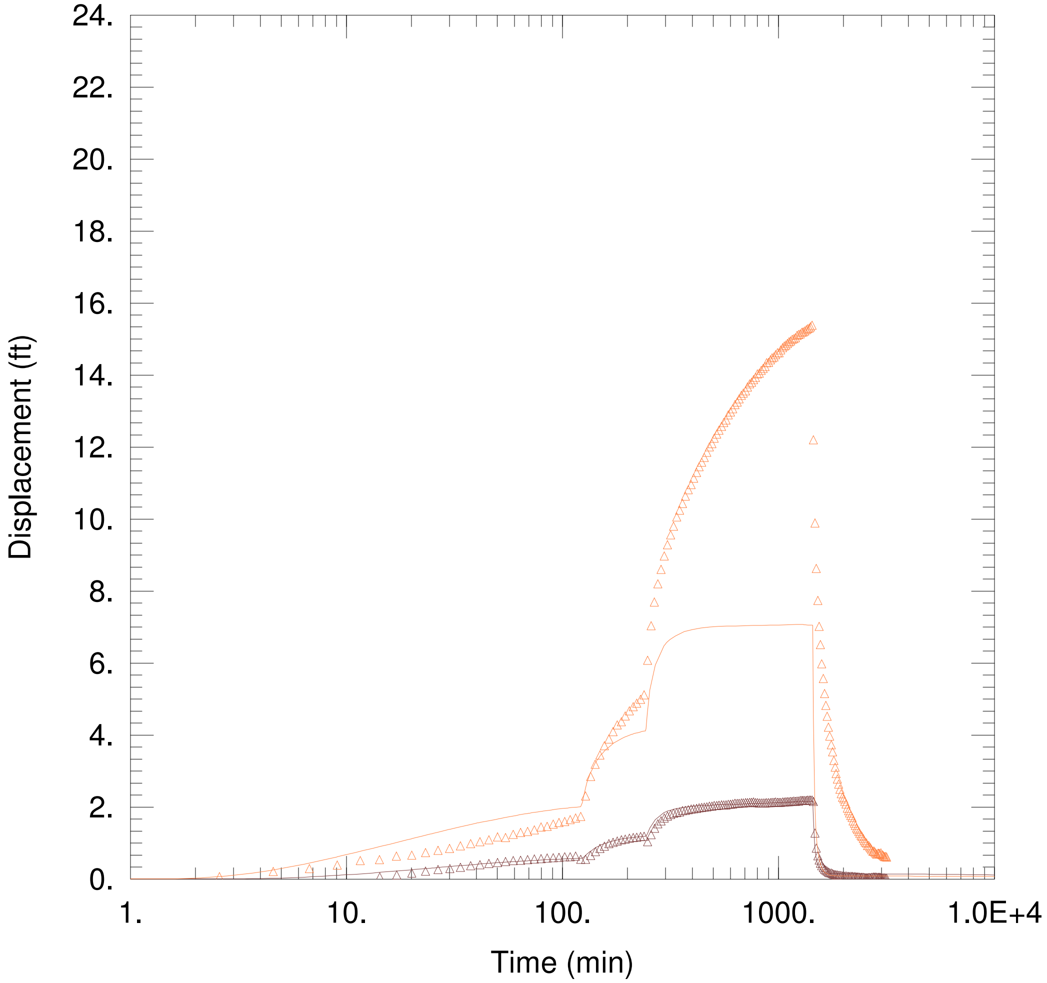
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2s	0	100
△ OWA2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1319.1 ft^2/day
S = 0.004789
Sy = 0.02875
Kz/Kr = 0.02568



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA2S.aqt
Date: 03/29/19 Time: 10:00:14

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

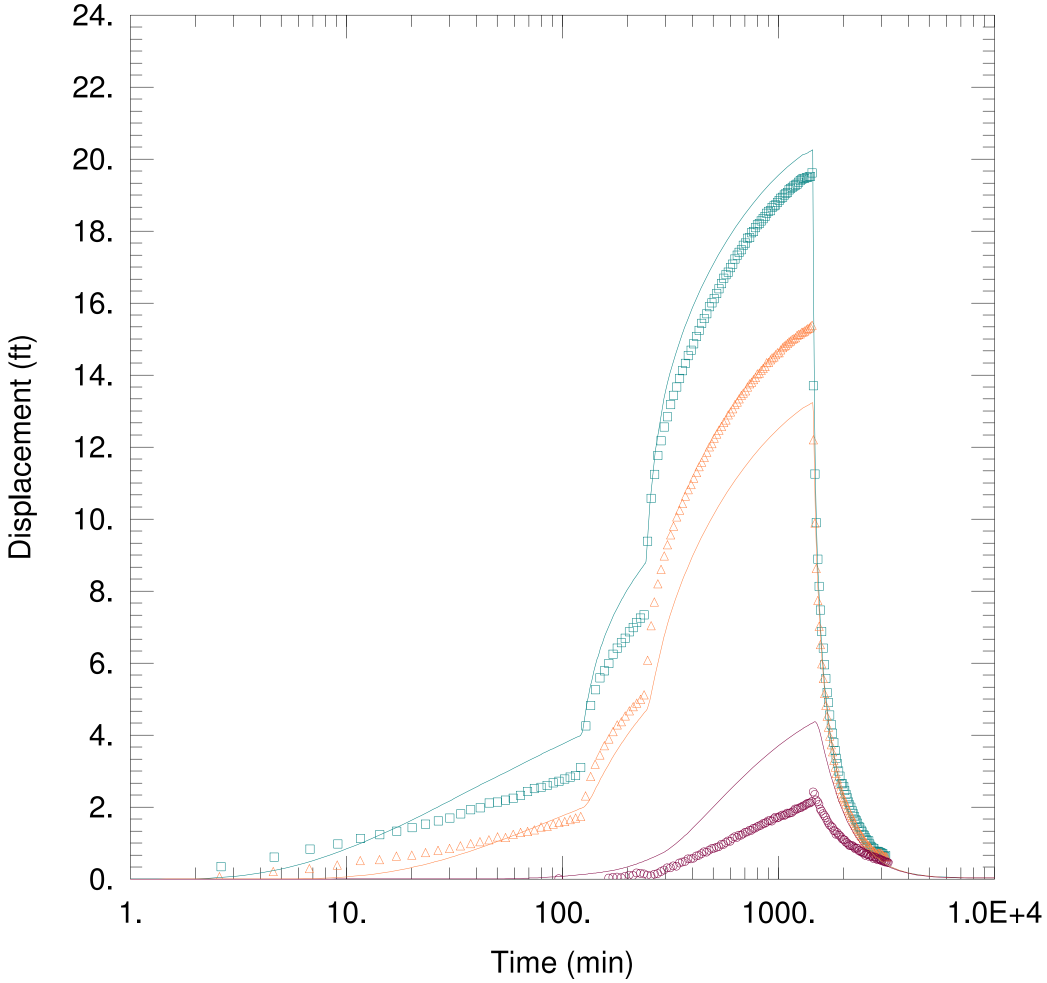
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWA2s	0	100
△ OWA2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1800. ft^2/day
S = 0.002
Sy = 0.5
Kz/Kr = 0.1



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\unconf\2wells\PWA_OWA1D_2D_3D.aqt
Date: 03/29/19 Time: 10:39:00

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

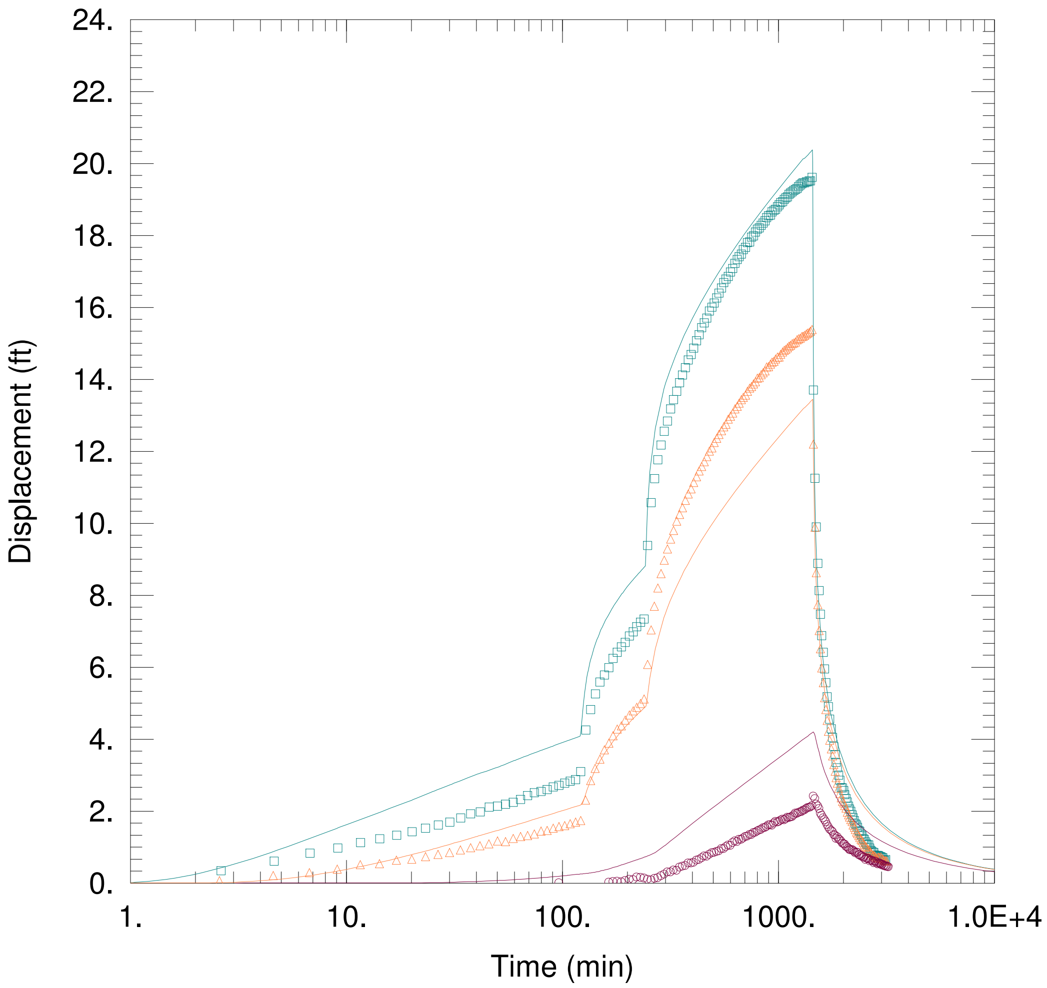
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50
△ OWA2d	0	100
○ OWA3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1307. ft^2/day
S = 0.007685
Sy = 0.5
Kz/Kr = 0.03771



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWA\leaky\PWAob1d_2d_3d_NW.aqt
Date: 03/29/19
Time: 10:43:56

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-A

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ OWA1d	0	50
△ OWA2d	0	100
○ OWA3d	0	300

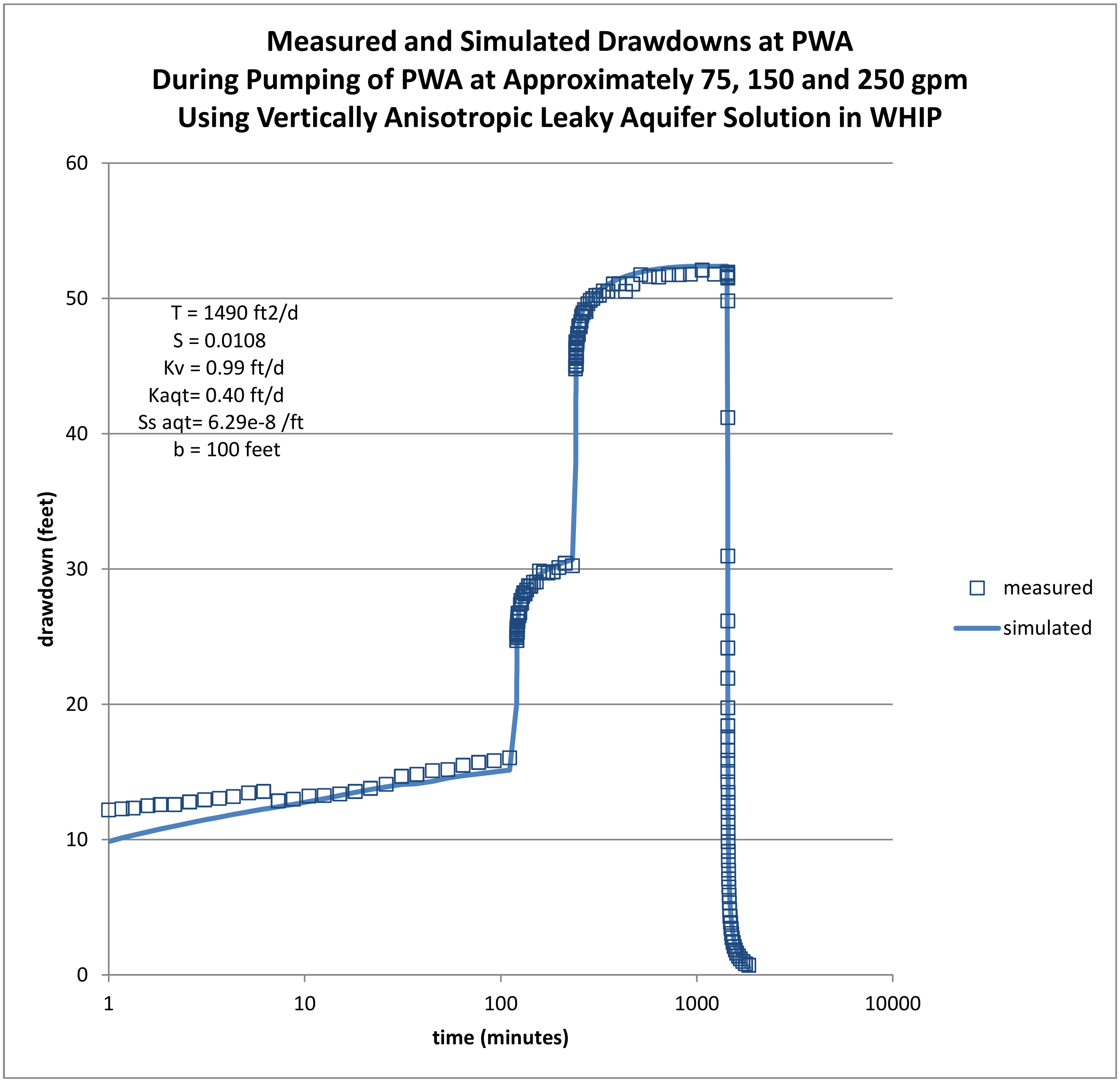
SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

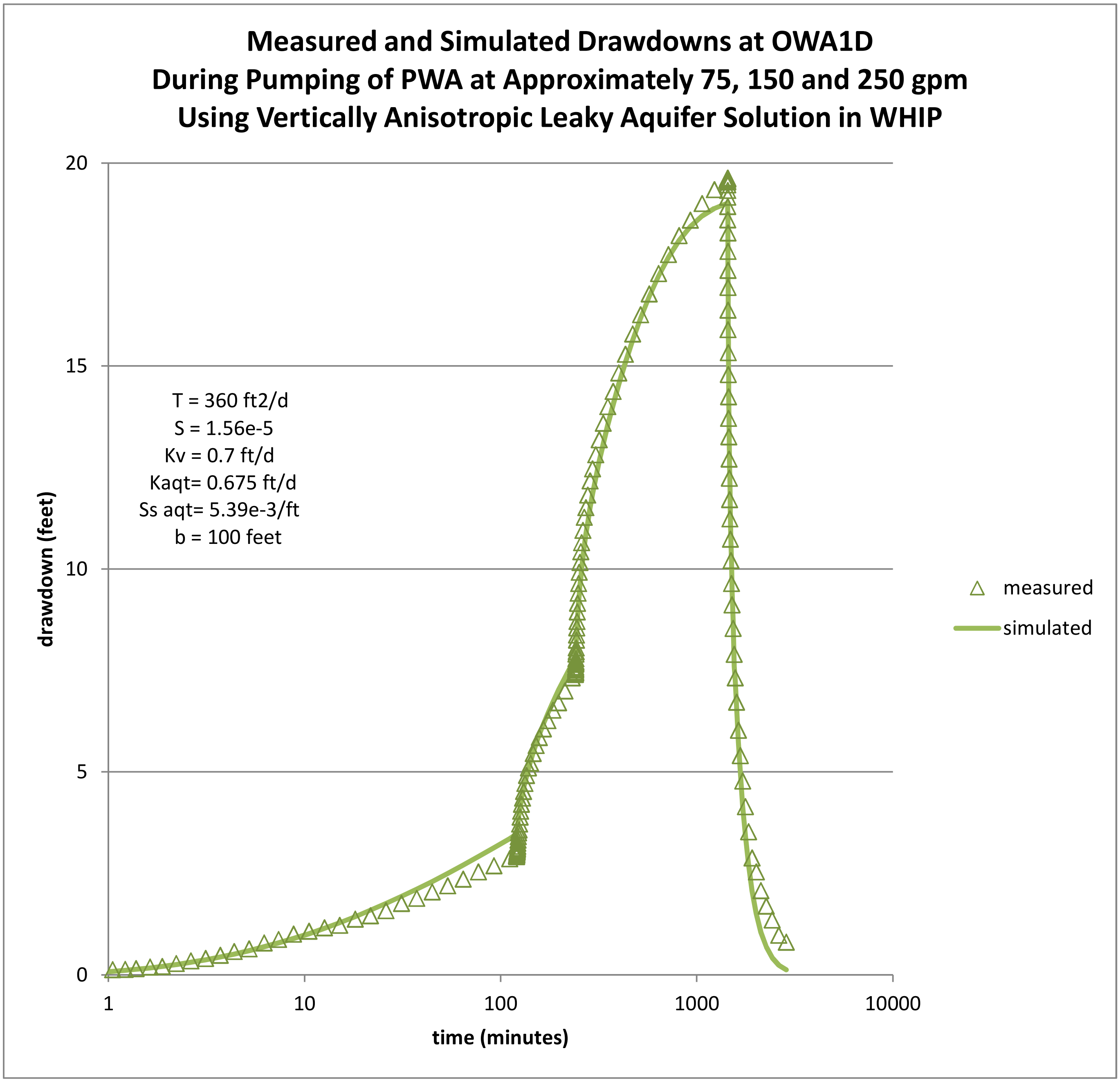
T = 717.9 ft^2/day
1/B = 2.0E-5 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.001261
ß/r = 0.002419 ft^{-1}
S2 = 1.0E-10

APPENDIX C

WHIP PWA TEST PLOTS

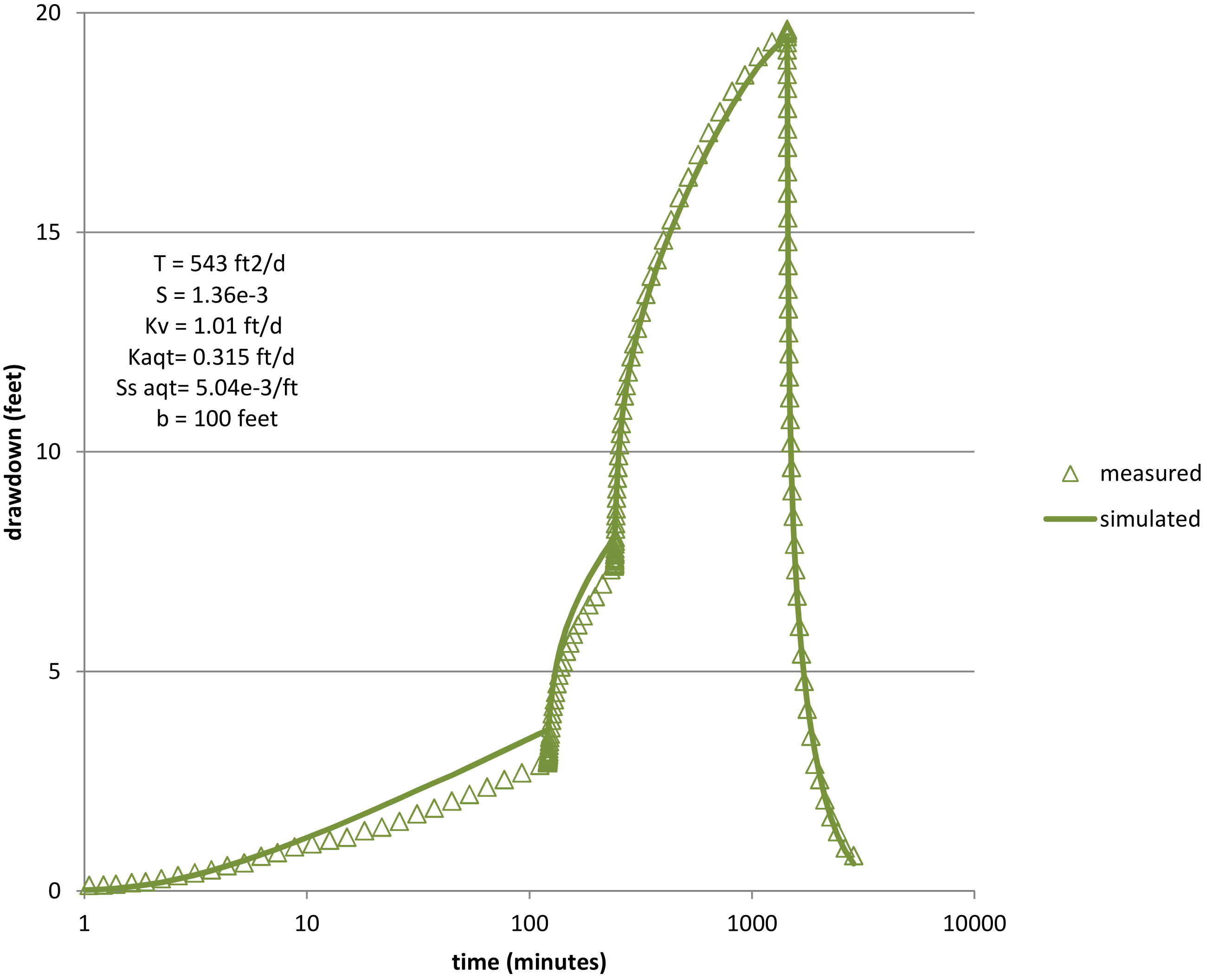


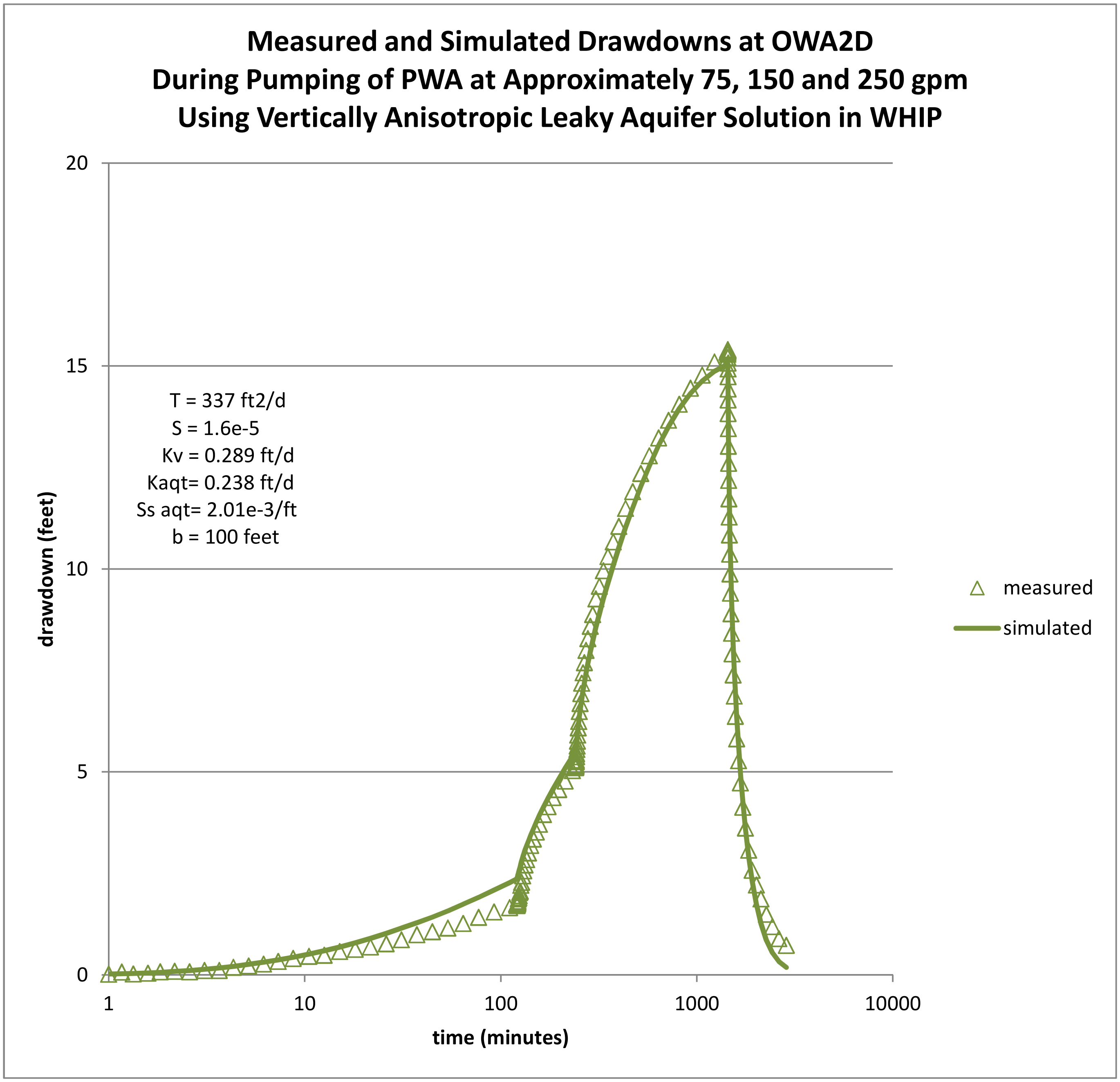
Measured and Simulated Drawdowns at PWA
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

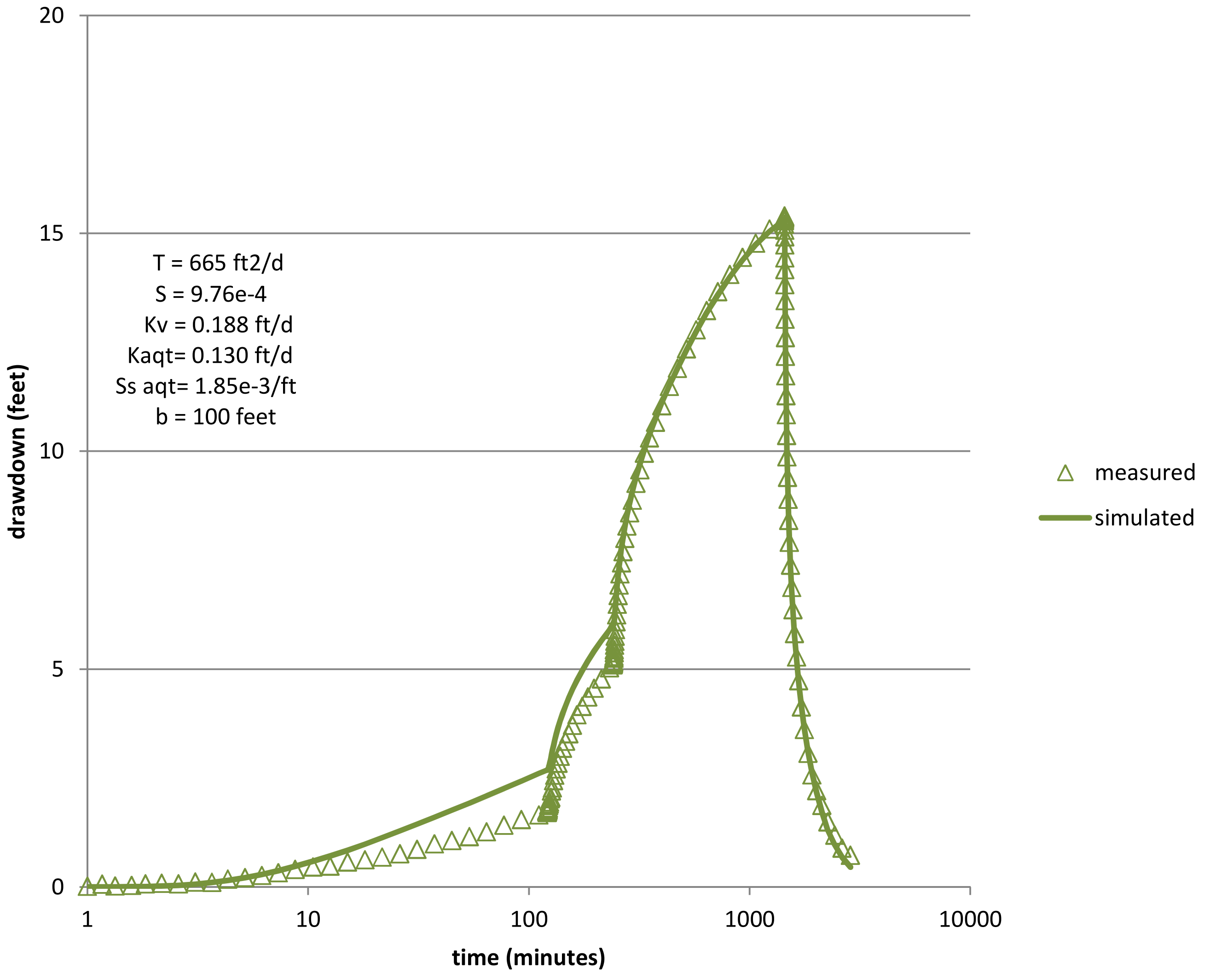


Measured and Simulated Drawdowns at OWA1D
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

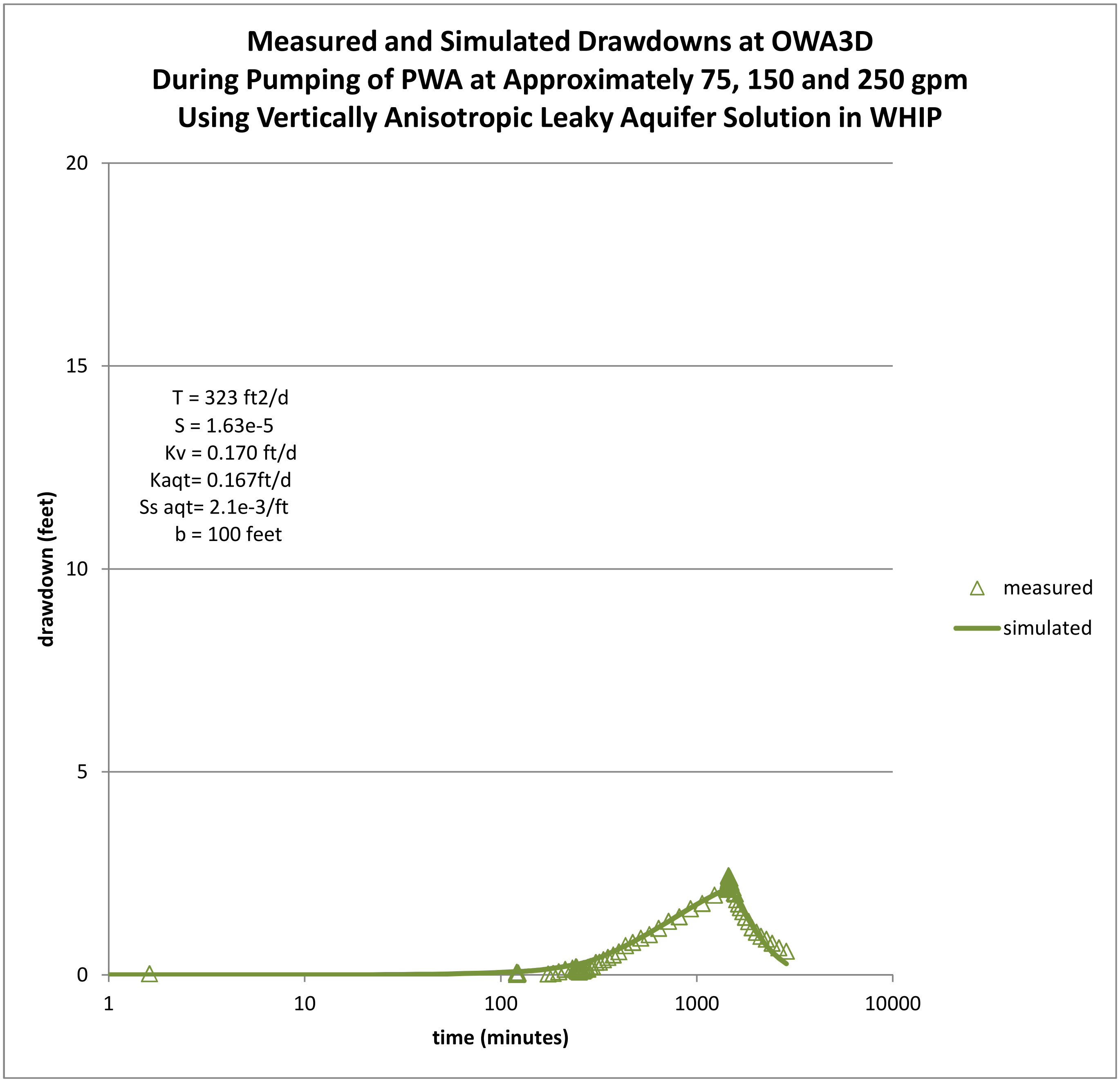
Measured and Simulated Drawdowns at OWA1D
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
(fitting recovery data)

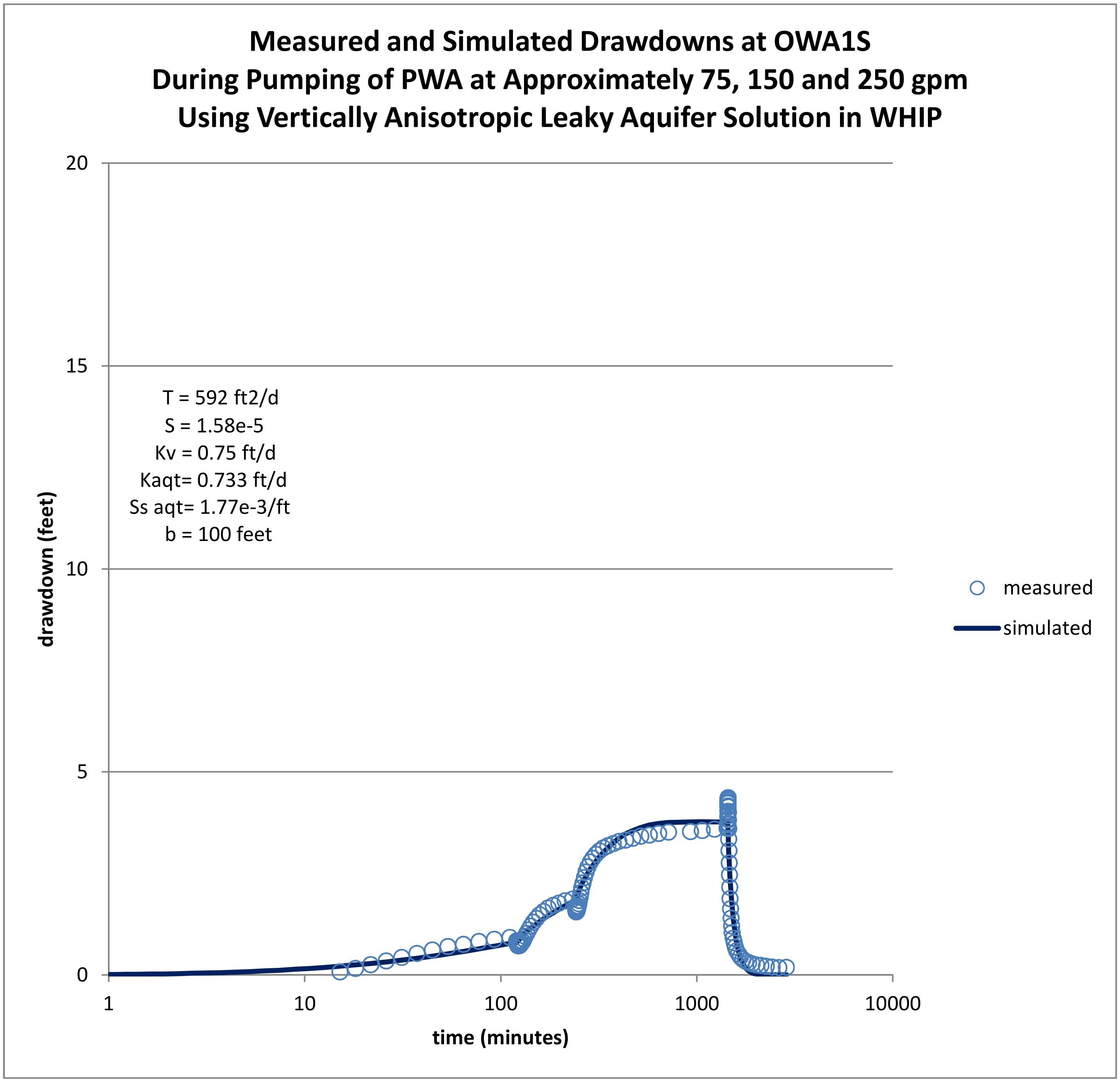


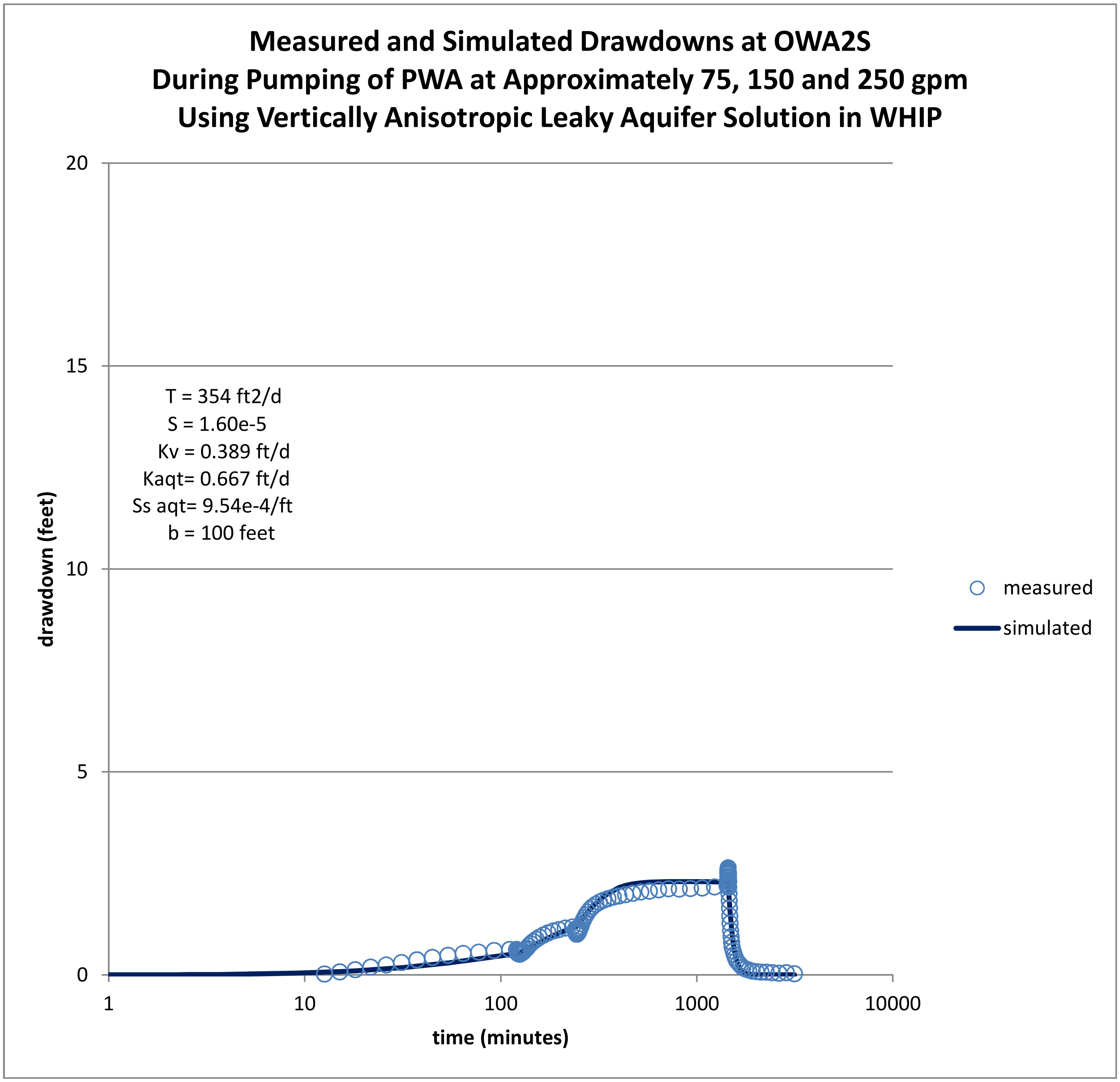

Measured and Simulated Drawdowns at OWA2D
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 337 ft2/d
S = 1.6e-5
Kv = 0.289 ft/d
Kaqt= 0.238 ft/d
Ss aqt= 2.01e-3/ft
b = 100 feet
drawdown (feet)
0
5
10
15
20
time (minutes)
1
10
100
1000
10000
△ measured
simulated



Measured and Simulated Drawdowns at OWA2D
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
(fitting recovery data)

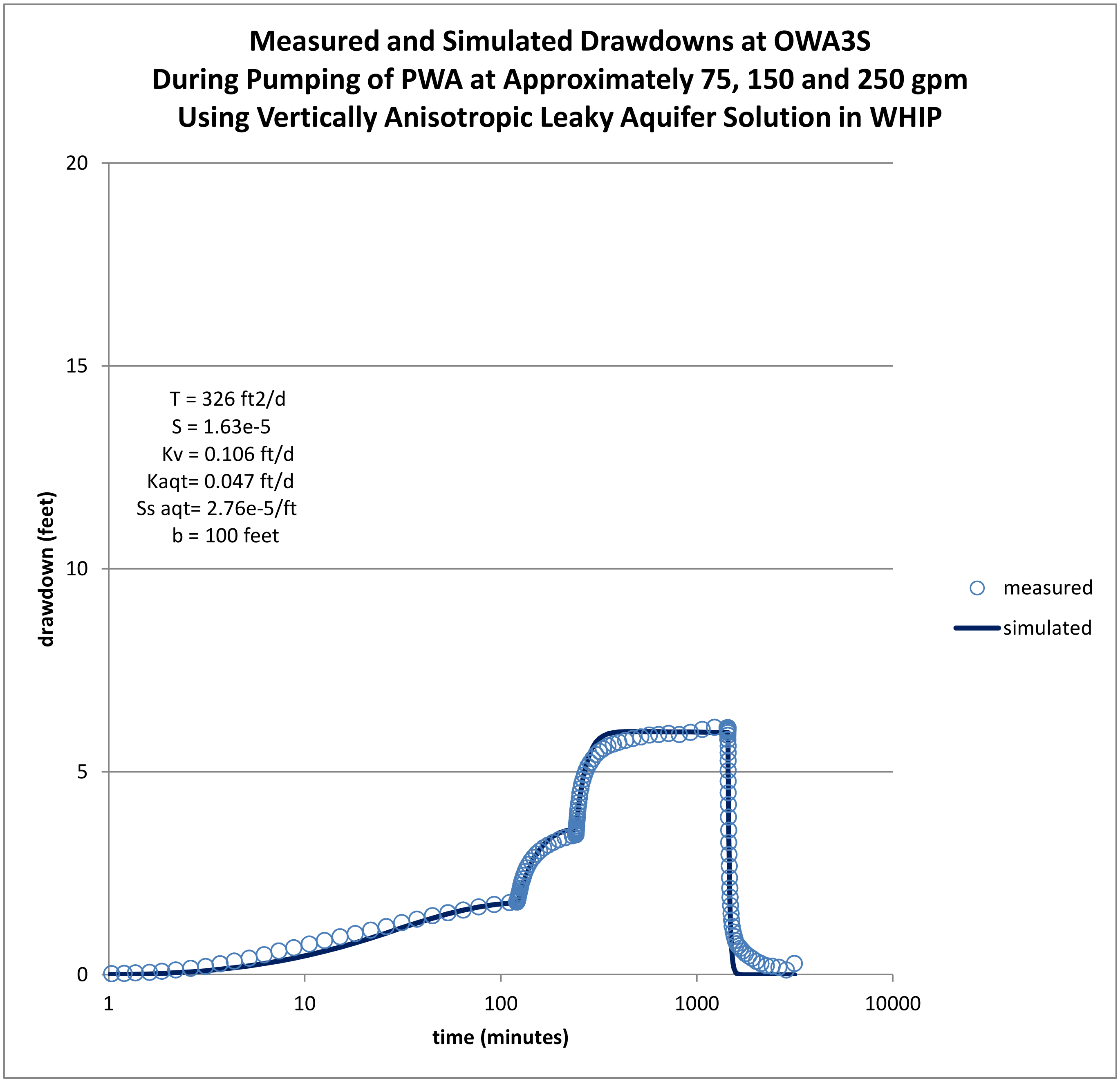

Measured and Simulated Drawdowns at OWA3D
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 323 ft2/d
S = 1.63e-5
Kv = 0.170 ft/d
Kaqt= 0.167ft/d
Ss aqt= 2.1e-3/ft
b = 100 feet
drawdown (feet)
20
15
10
5
0
1
10
100
1000
10000
time (minutes)
△ measured
simulated

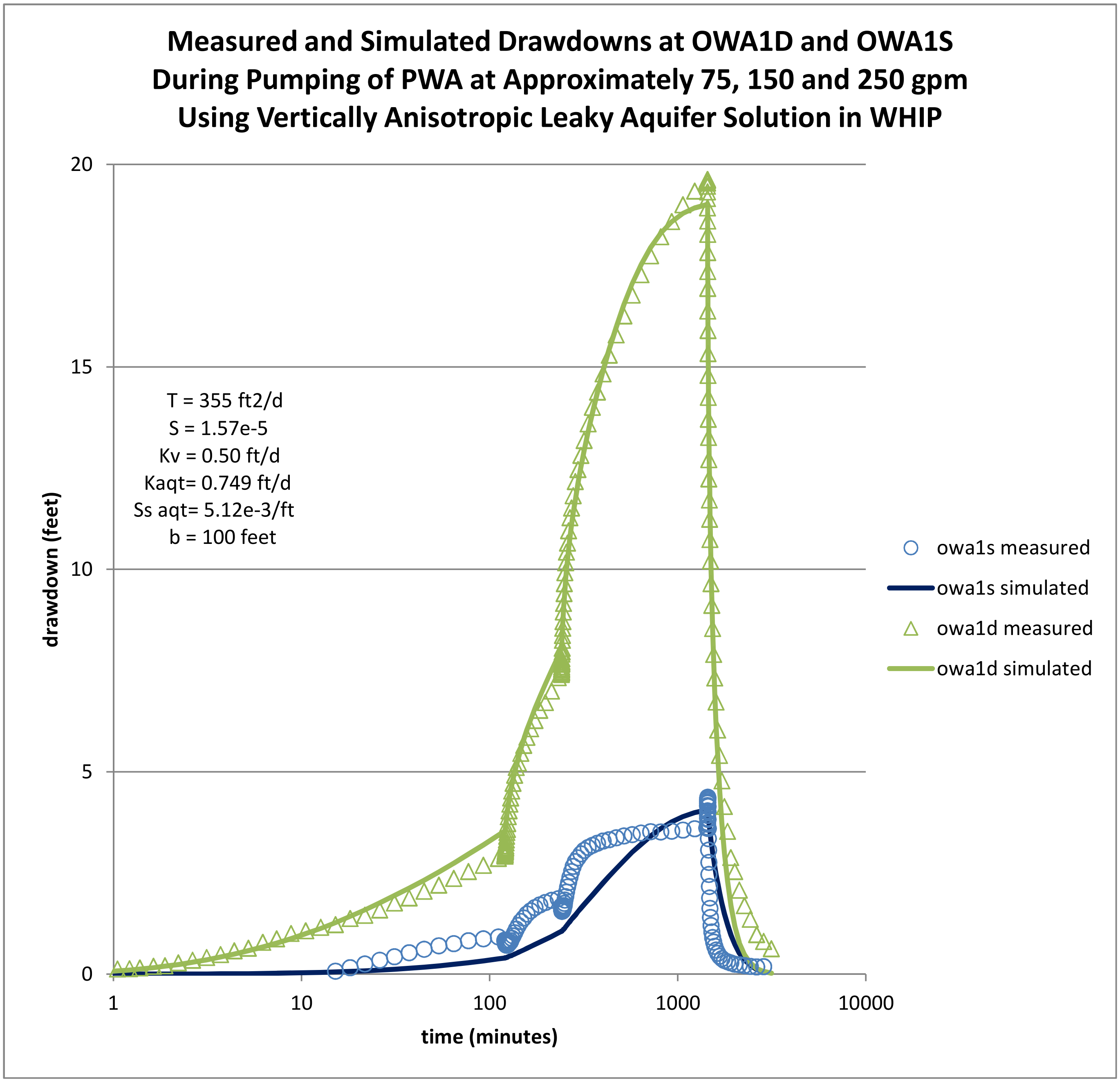

Measured and Simulated Drawdowns at OWA1S
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 592 ft2/d
S = 1.58e-5
Kv = 0.75 ft/d
Kaqt= 0.733 ft/d
Ss aqt= 1.77e-3/ft
b = 100 feet
drawdown (feet)
20
15
10
5
0
1
10
100
1000
10000
time (minutes)
measured
simulated



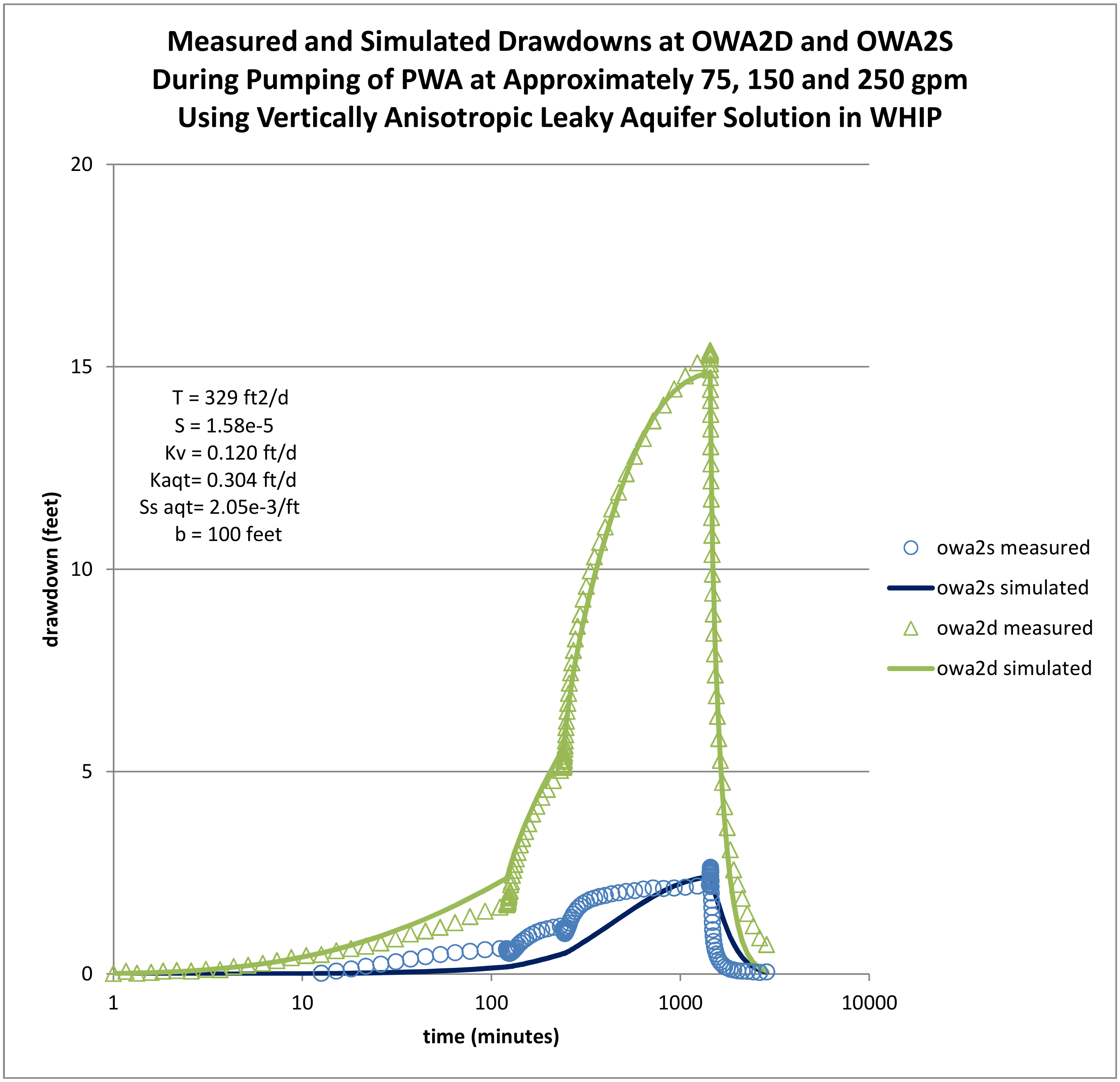
Measured and Simulated Drawdowns at OWA2S
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

T = 354 ft2/d
S = 1.60e-5
Kv = 0.389 ft/d
Kaqt= 0.667 ft/d
Ss aqt= 9.54e-4/ft
b = 100 feet


Measured and Simulated Drawdowns at OWA3S
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 326 ft2/d
S = 1.63e-5
Kv = 0.106 ft/d
Kaqt= 0.047 ft/d
Ss aqt= 2.76e-5/ft
b = 100 feet
drawdown (feet)
20
15
10
5
0
1
10
100
1000
10000
time (minutes)
measured
simulated

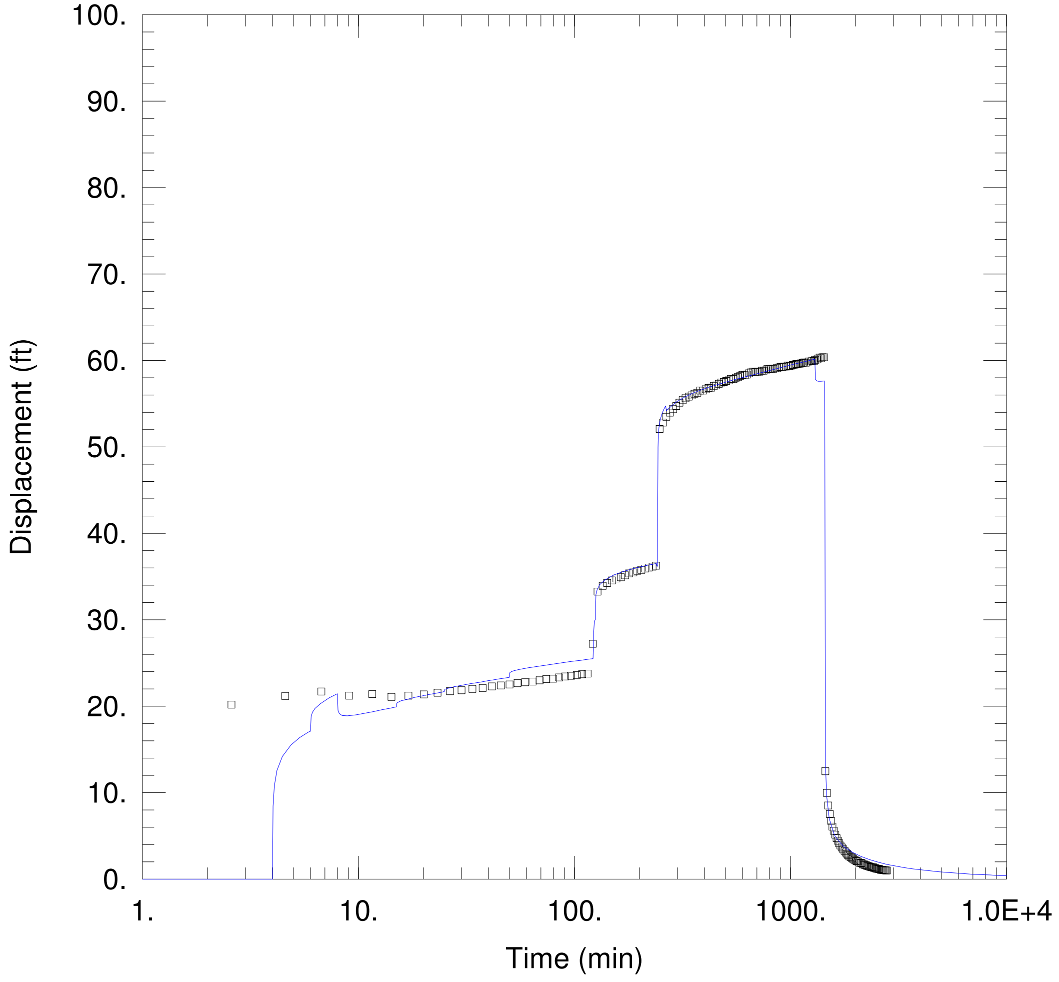


Measured and Simulated Drawdowns at OWA1D and OWA1S
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP


Measured and Simulated Drawdowns at OWA2D and OWA2S
During Pumping of PWA at Approximately 75, 150 and 250 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 329 ft2/d
S = 1.58e-5
Kv = 0.120 ft/d
Kaqt= 0.304 ft/d
Ss aqt= 2.05e-3/ft
b = 100 feet
drawdown (feet)
0
5
10
15
20
time (minutes)
1
10
100
1000
10000
owa2s measured
owa2s simulated
owa2d measured
owa2d simulated

APPENDIX D

AQTESOLV PWB TEST PLOTS



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\PWB.aqt
Date: 03/27/19 Time: 14:20:03

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ PW-B	0	0

SOLUTION

Aquifer Model: Unconfined

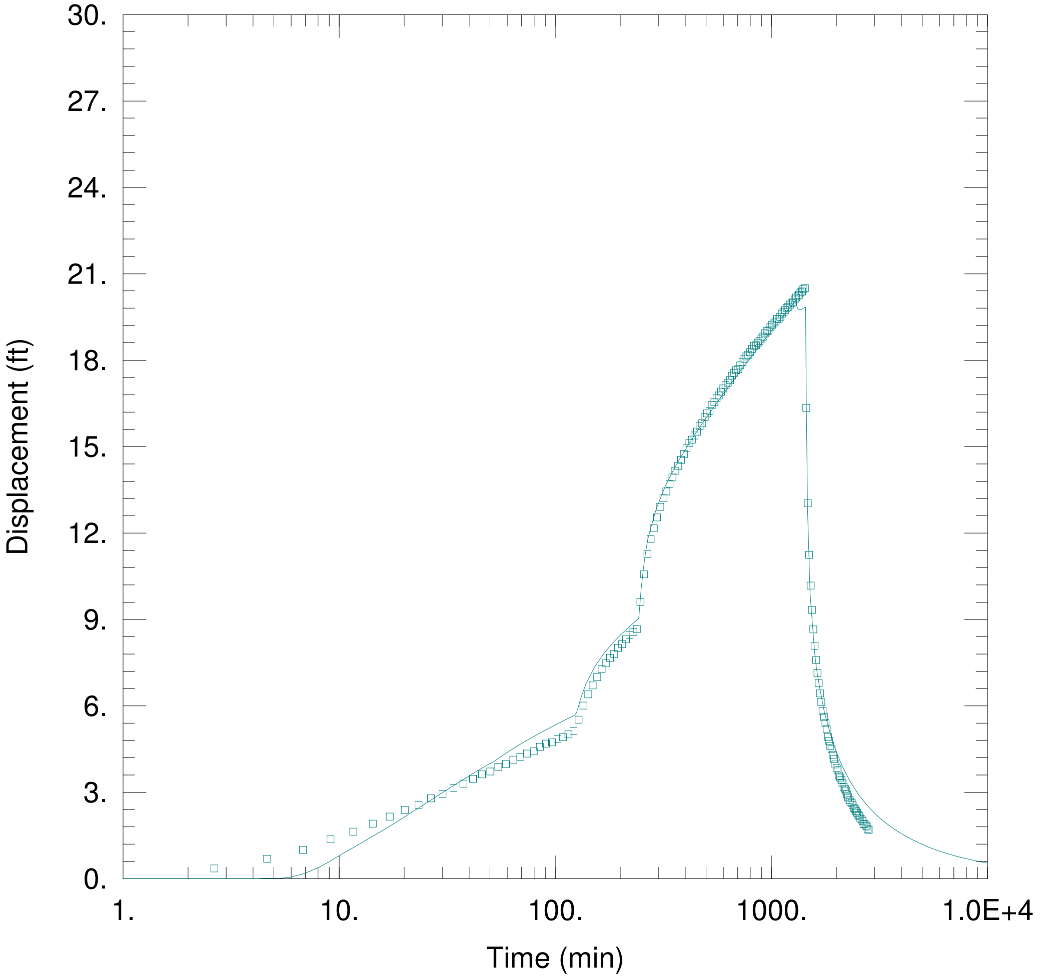
Solution Method: Neuman

T = 697. ft^2/day

S = 0.002418

Sy = 0.001

ß = 1.89E-6



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob1d.aqt
Date: 04/15/19 Time: 13:58:44

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

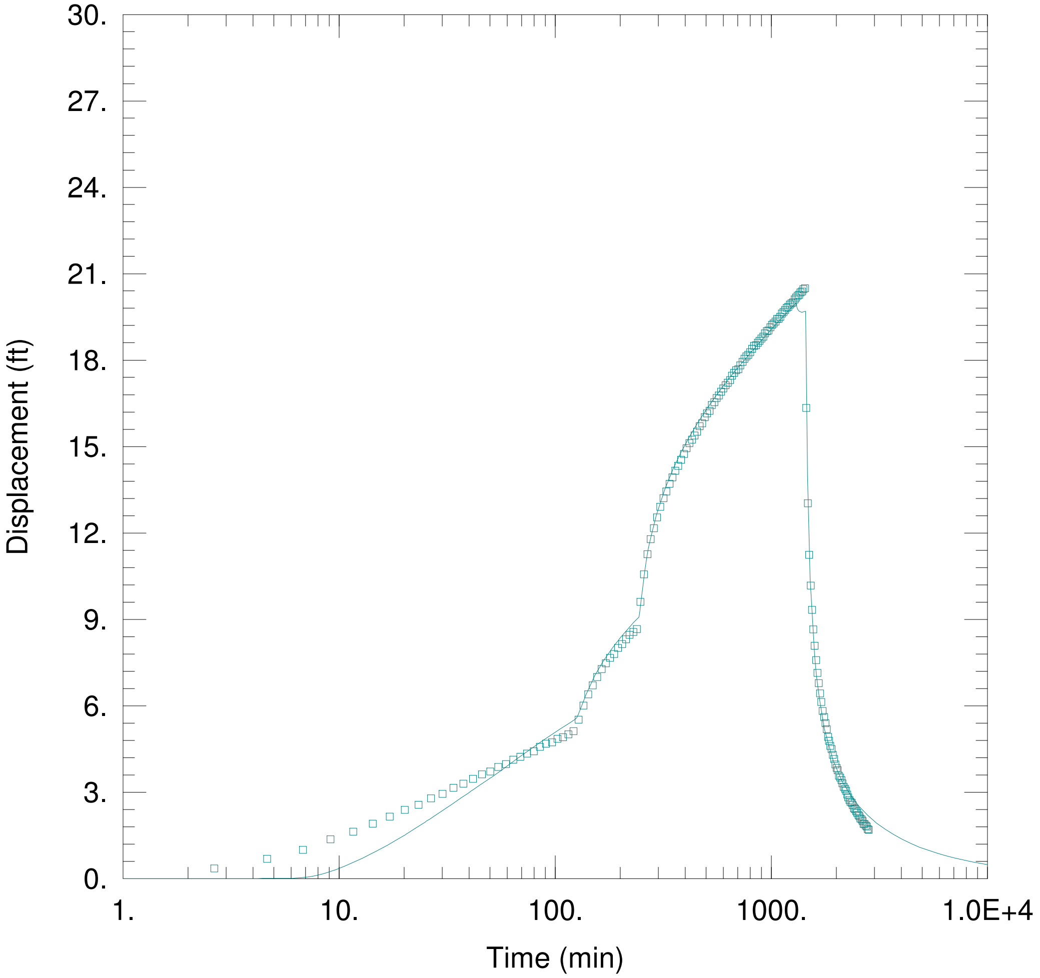
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 478.1 ft^2/day
Sy = 0.001
S = 0.002919
Kz/Kr = 0.3432



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob1d2.aqt
Date: 04/15/19 Time: 14:00:13

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

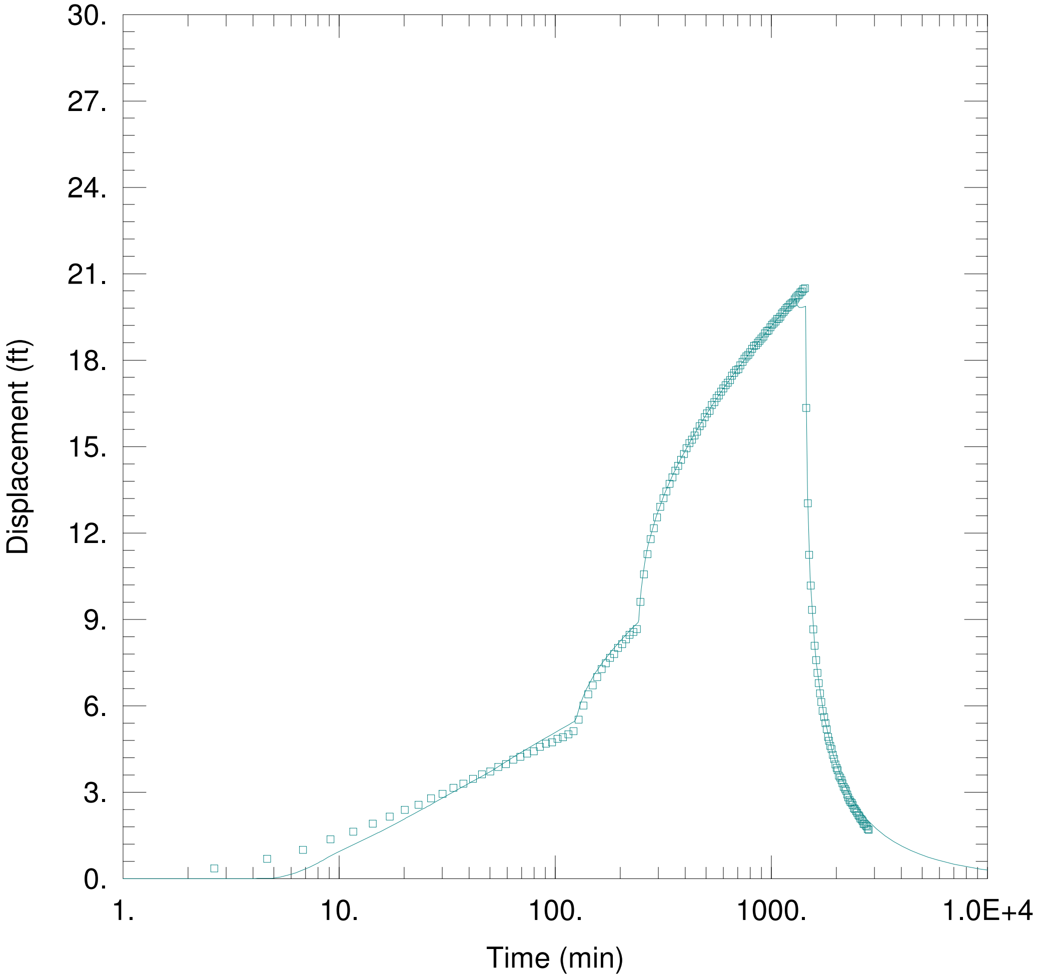
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 529. ft^2/day
S = 0.004956
Sy = 0.001
Kz/Kr = 0.101



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob1d3.aqt
Date: 04/15/19 Time: 14:01:07

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

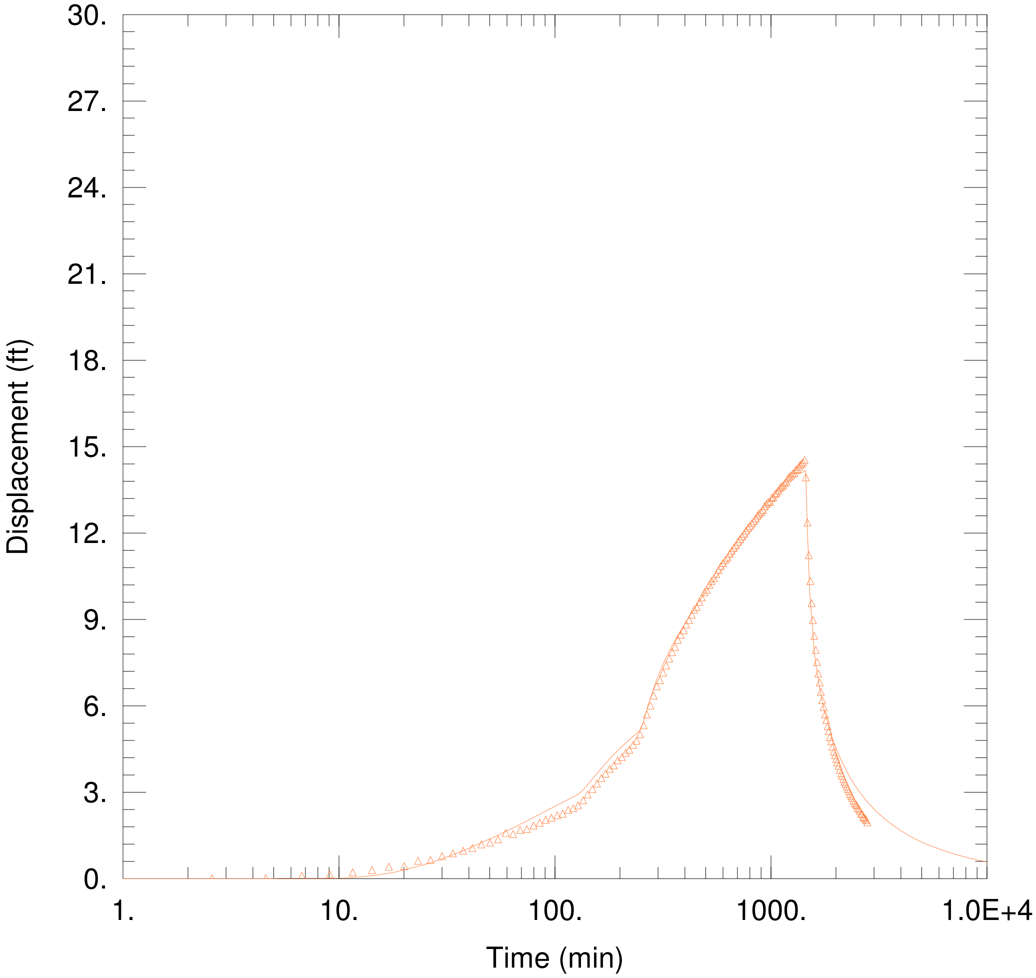
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 900.8 ft^2/day
Sy = 0.25
S = 0.003201
Kz/Kr = 0.001186



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob2d.aqt
Date: 04/15/19 Time: 14:08:26

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

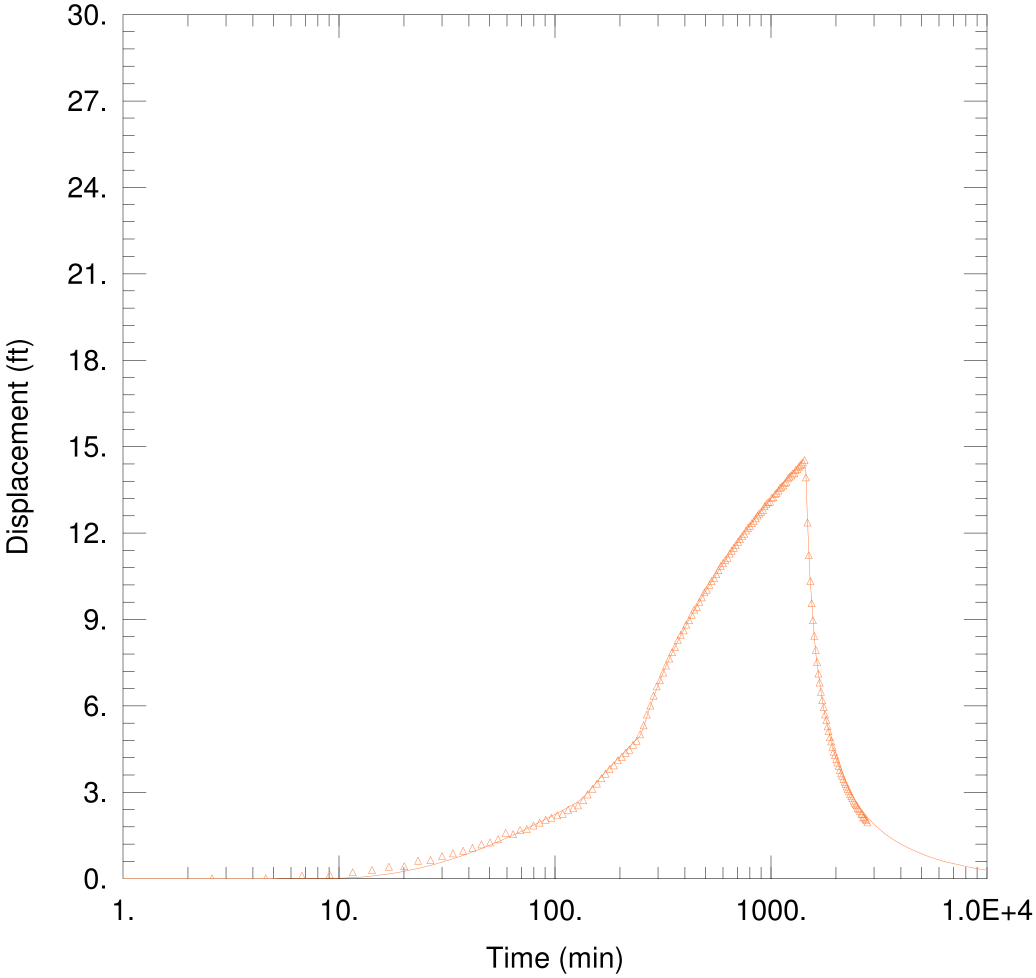
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 442.3 ft^2/day
Sy = 0.001
S = 0.002953
Kz/Kr = 0.2292



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob2d2.aqt
Date: 04/15/19 Time: 14:07:55

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

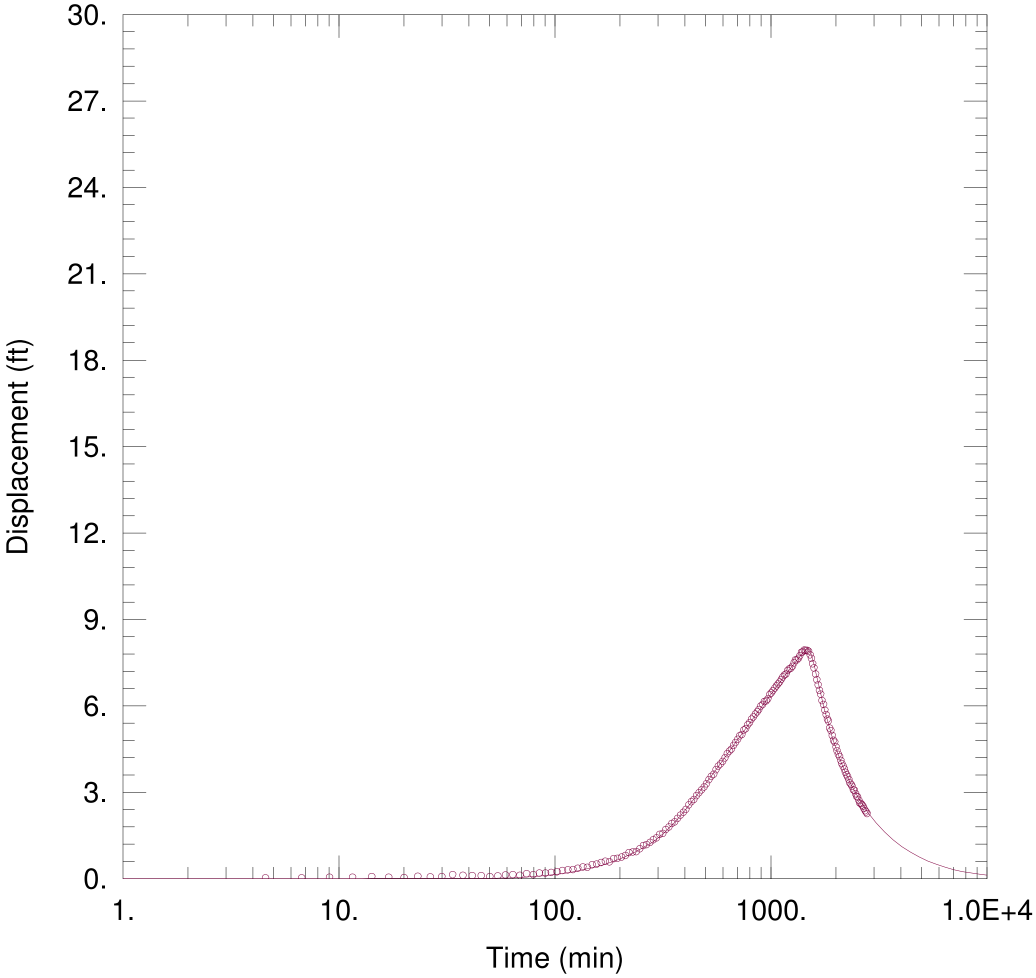
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2d	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 808.2 ft^2/day
S = 0.004784
Sy = 0.25
Kz/Kr = 0.002553



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob3d.aqt
Date: 04/15/19 Time: 14:10:37

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

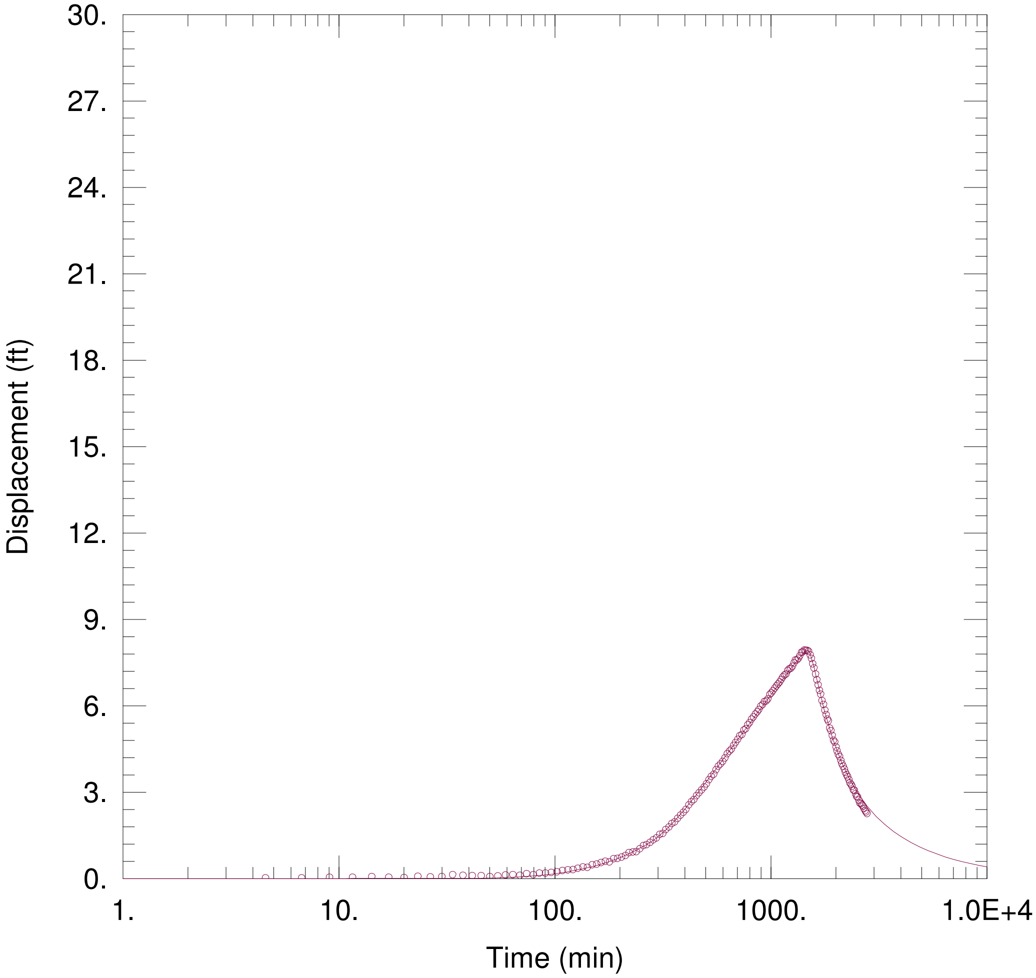
Observation Wells

Well Name	X (ft)	Y (ft)
◦ OWB3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 474.5 ft^2/day
S = 0.002944
Sy = 0.25
Kz/Kr = 0.01052



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob3d2.aqt
Date: 04/15/19 Time: 14:11:12

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

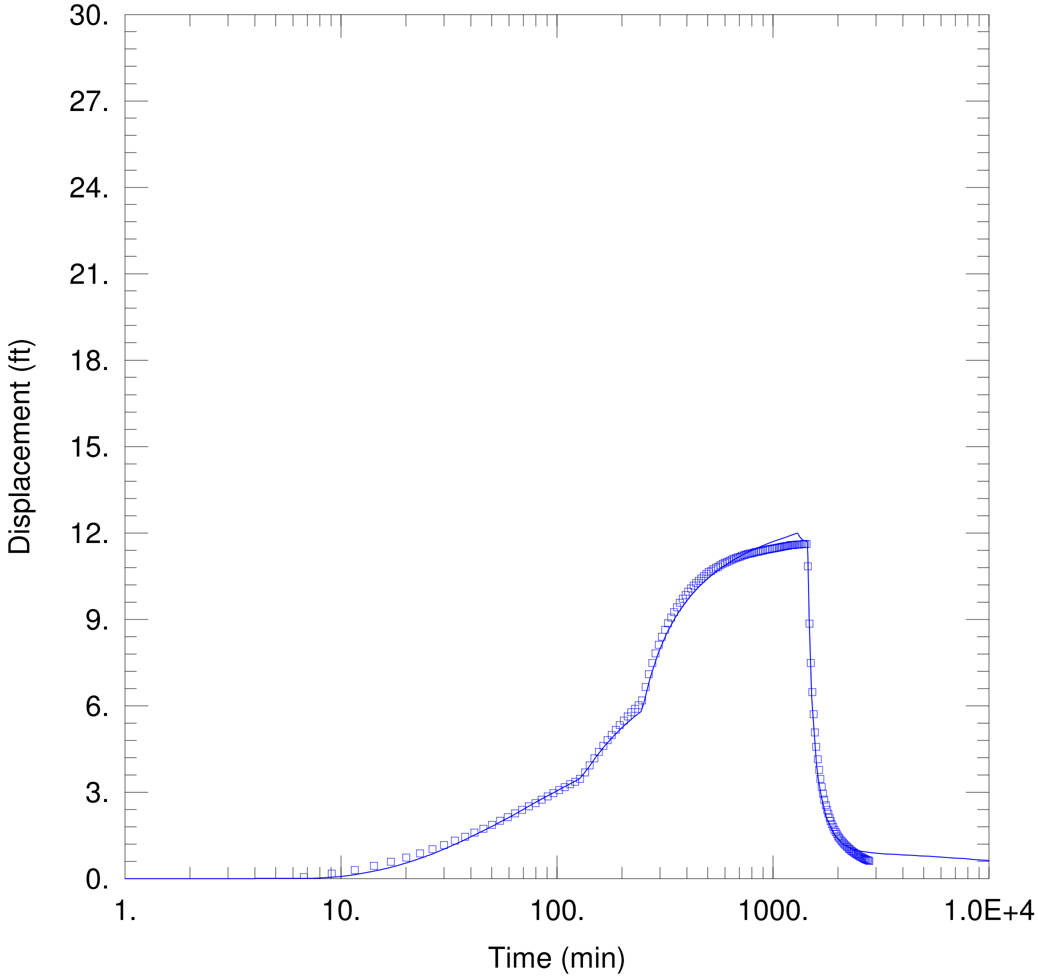
Observation Wells

Well Name	X (ft)	Y (ft)
◦ OWB3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 674.2 ft^2/day
S = 0.003427
Sy = 0.25
Kz/Kr = 0.001574



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob1s.aqt
Date: 04/15/19 Time: 14:01:44

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

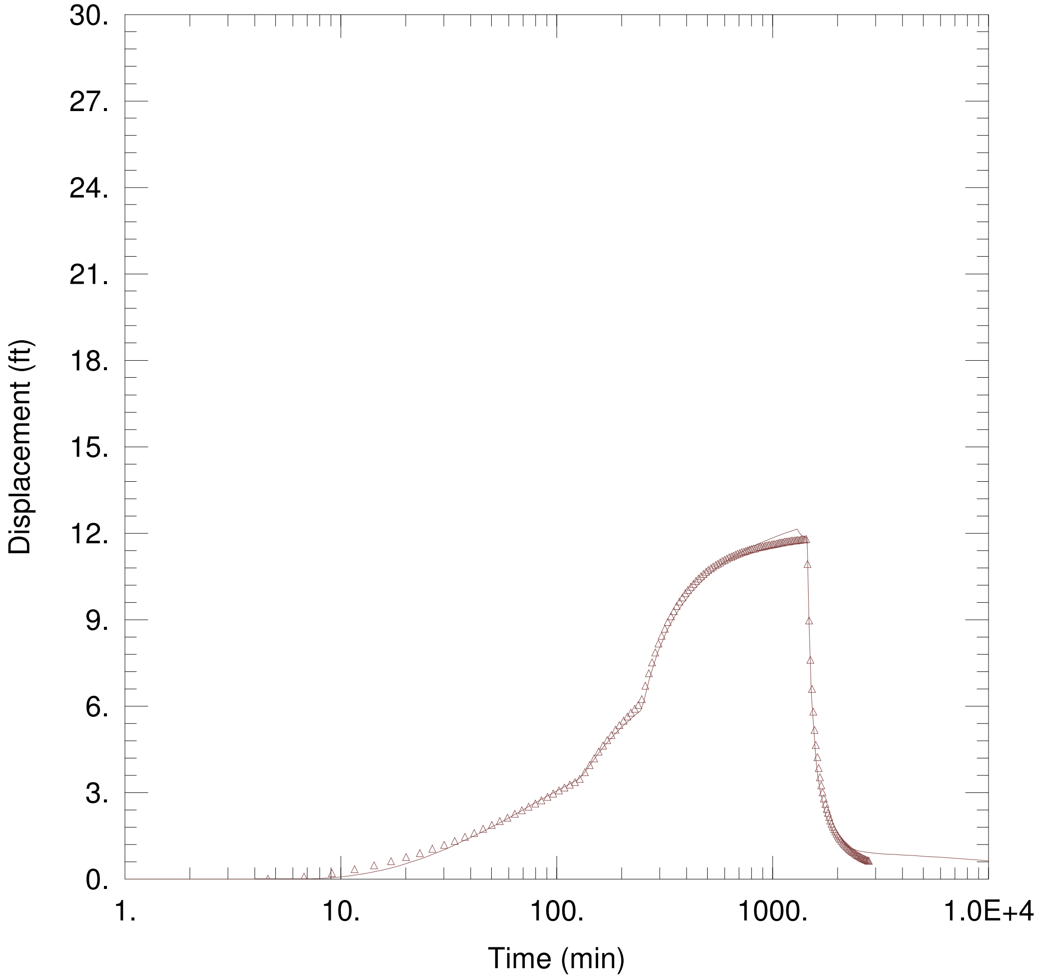
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1s	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 223.6 ft^2/day
S = 0.0001192
Sy = 0.004584
Kz/Kr = 0.01089



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob2s.aqt
Date: 04/15/19 Time: 14:09:09

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

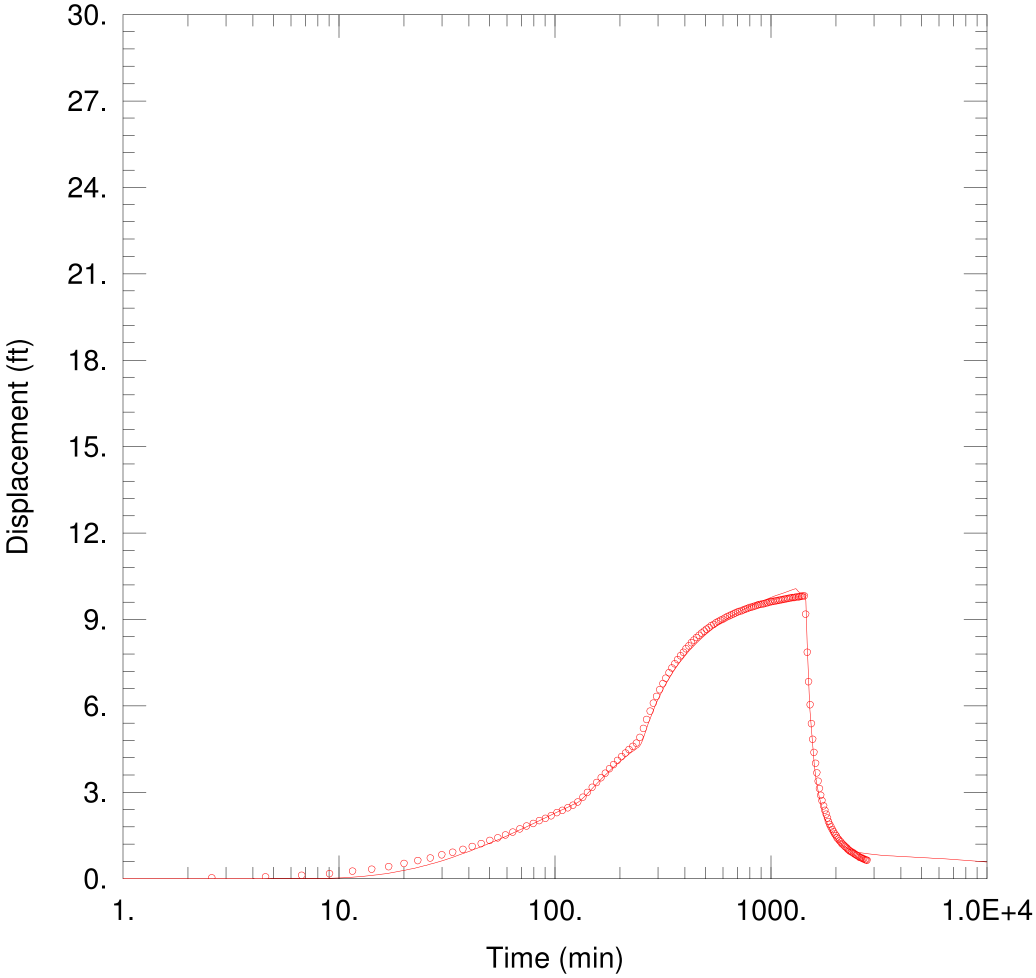
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2s	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 220.6 ft^2/day
S = 2.96E-5
Sy = 0.001125
Kz/Kr = 0.002689



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob3s.aqt
Date: 04/15/19 Time: 14:12:06

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

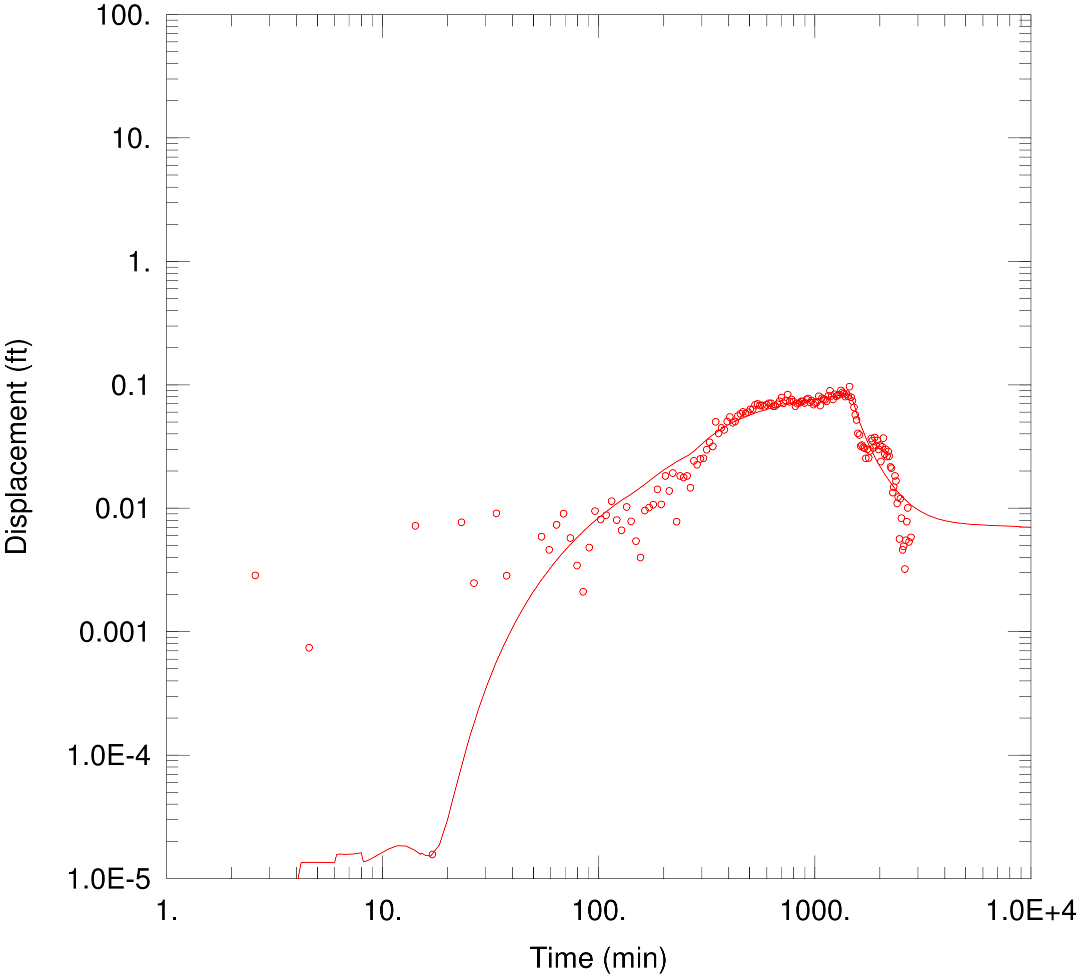
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3s	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 246.8 ft^2/day
Sy = 0.001
S = 3.089E-5
Kz/Kr = 0.002275



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob2bs.aqt
Date: 04/15/19 Time: 14:04:58

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

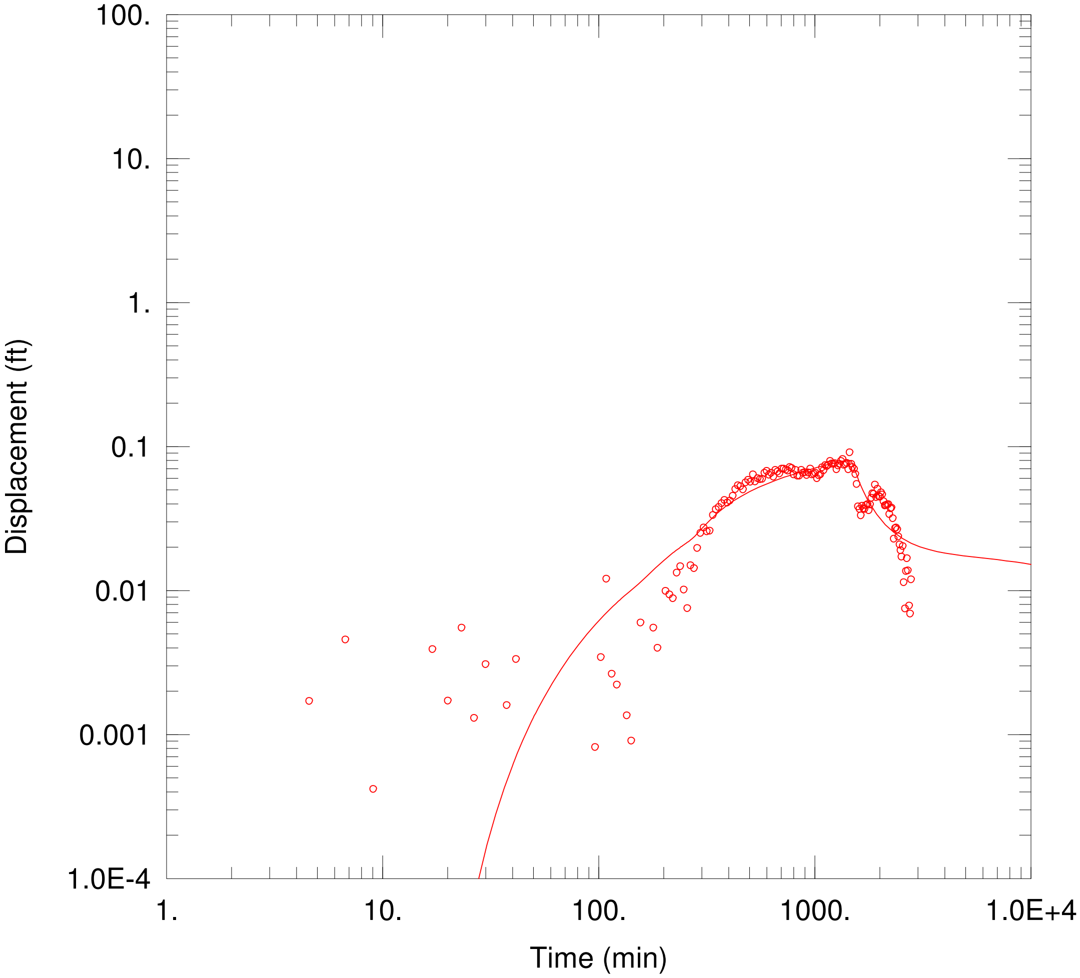
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB2Bs	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 5455. ft^2/day
S = 0.000137
Sy = 0.0178
Kz/Kr = 0.000216



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob3bs.aqt
Date: 04/15/19 Time: 14:09:55

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

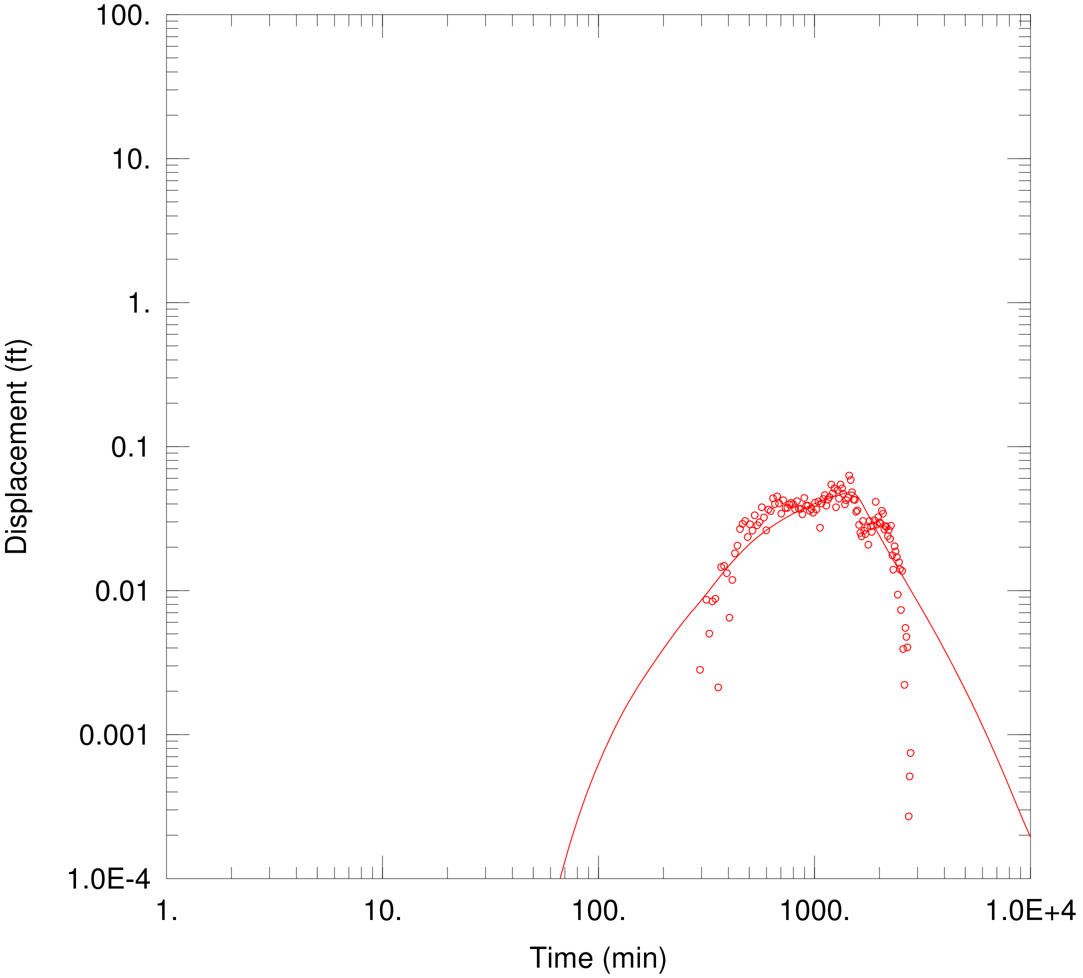
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3Bs	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 6147.9 ft^2/day
Sy = 0.002013
S = 5.01E-5
Kz/Kr = 6.13E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob4bs.aqt
Date: 04/15/19 Time: 14:13:00

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

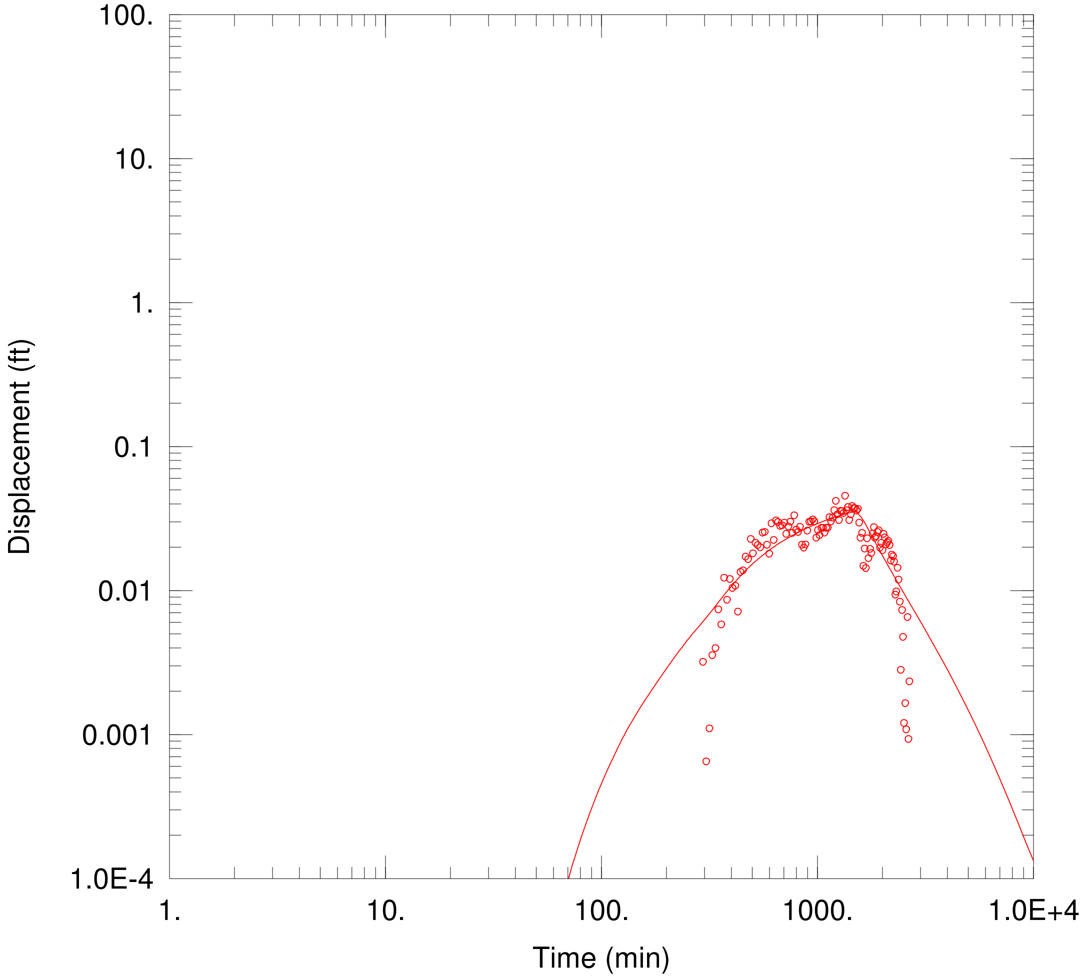
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB4Bs	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 6918.1 ft^2/day
S = 4.843E-5
Sy = 0.25
Kz/Kr = 2.053E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\1well\PWBob5bs.aqt
Date: 04/15/19 Time: 14:13:44

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

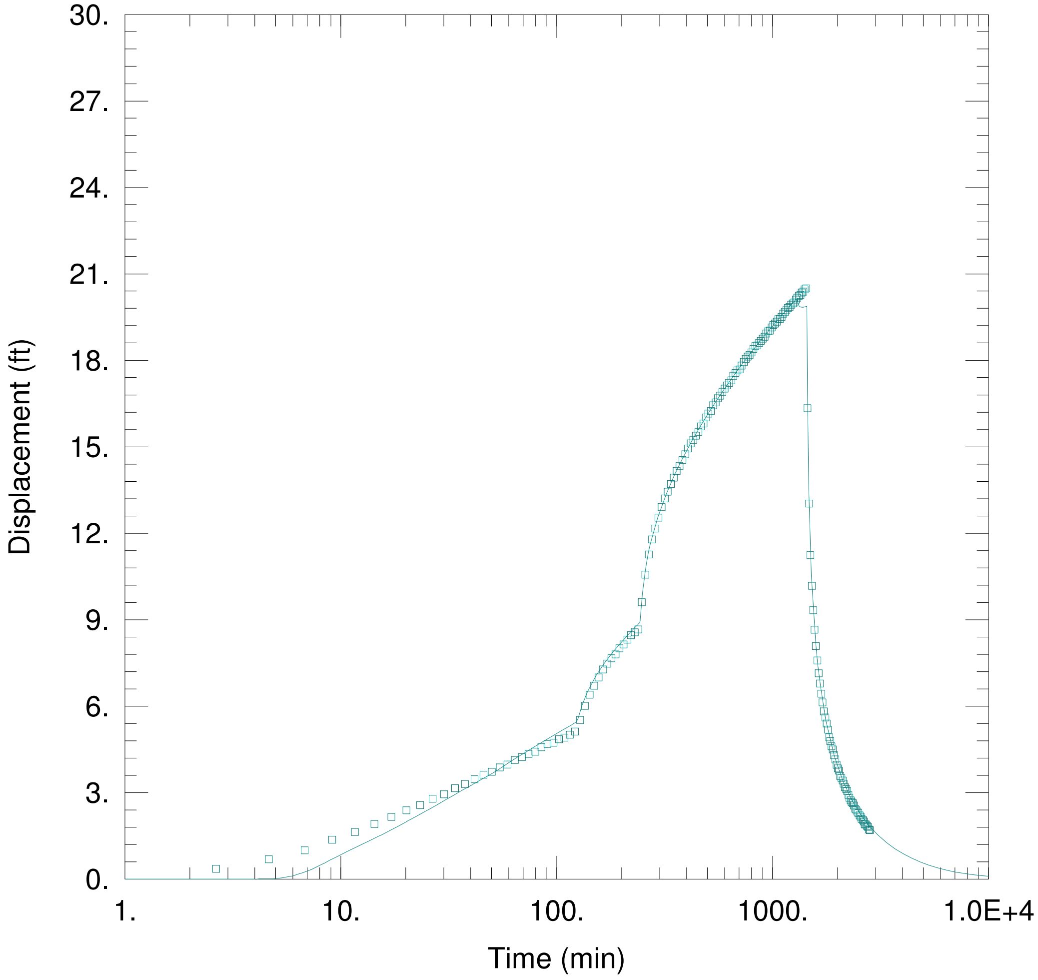
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB5Bs	0	100

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 9498.6 ft^2/day
S = 3.748E-5
Sy = 0.25
Kz/Kr = 1.158E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob1d_NW.aqt
Date: 03/27/19 Time: 16:09:19

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

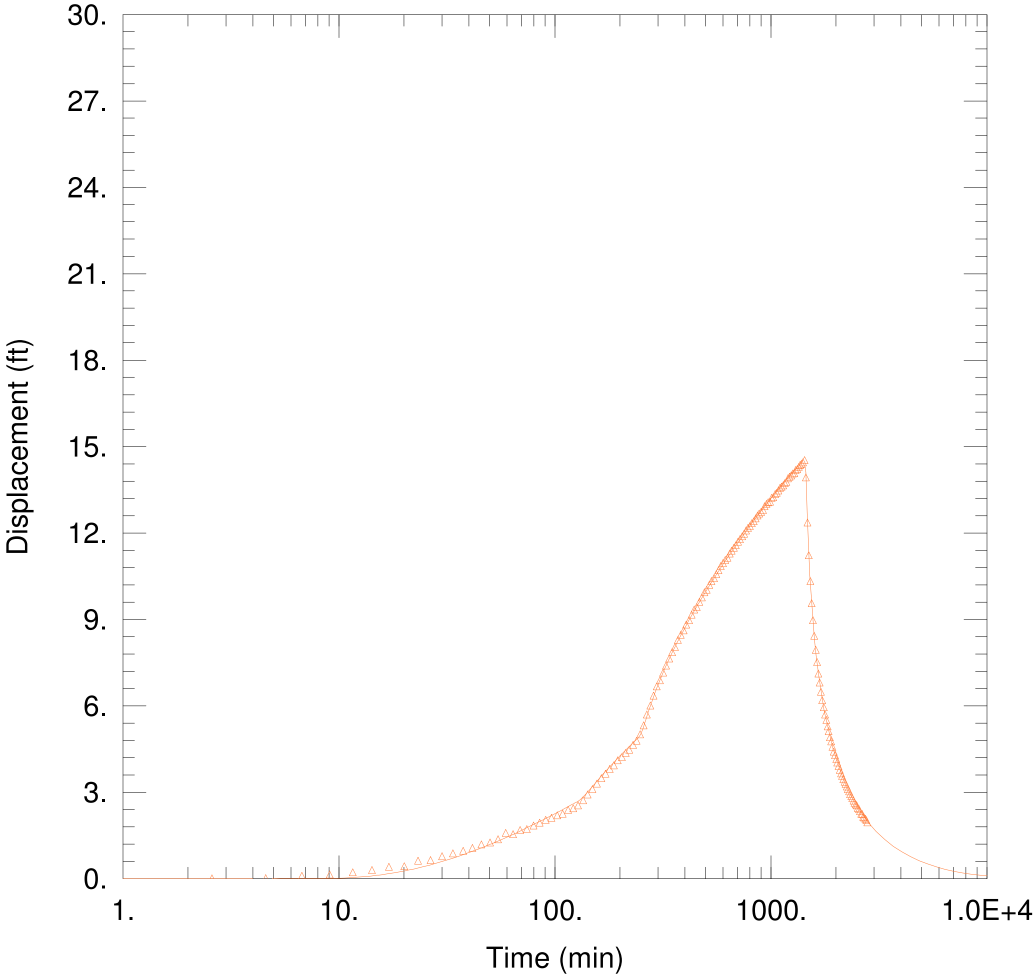
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1d	0	50

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 444.7 ft^2/day
1/B = 0.001103 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.001795
ß/r = 8.785E-5 ft^{-1}
S2 = 1.



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob2d_NW.aqt
Date: 03/27/19 Time: 16:10:34

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

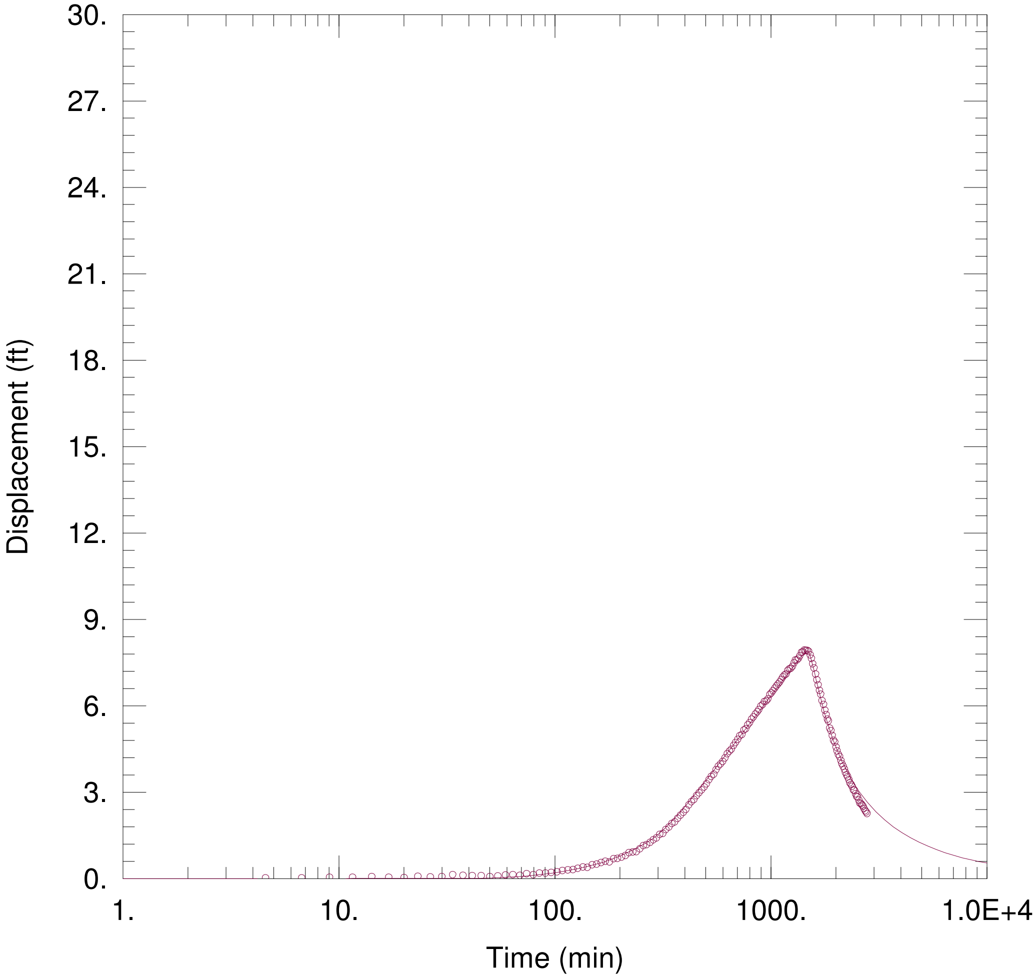
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2d	0	100

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 404.8 ft^2/day
1/B = 0.001379 ft^{-1}
T2 = 1.44E+8 ft^2/day
S = 0.002342
ß/r = 0.0001726 ft^{-1}
S2 = 1.



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob3d_NW.aqt
Date: 03/27/19 Time: 16:12:09

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b'): 10. ft
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

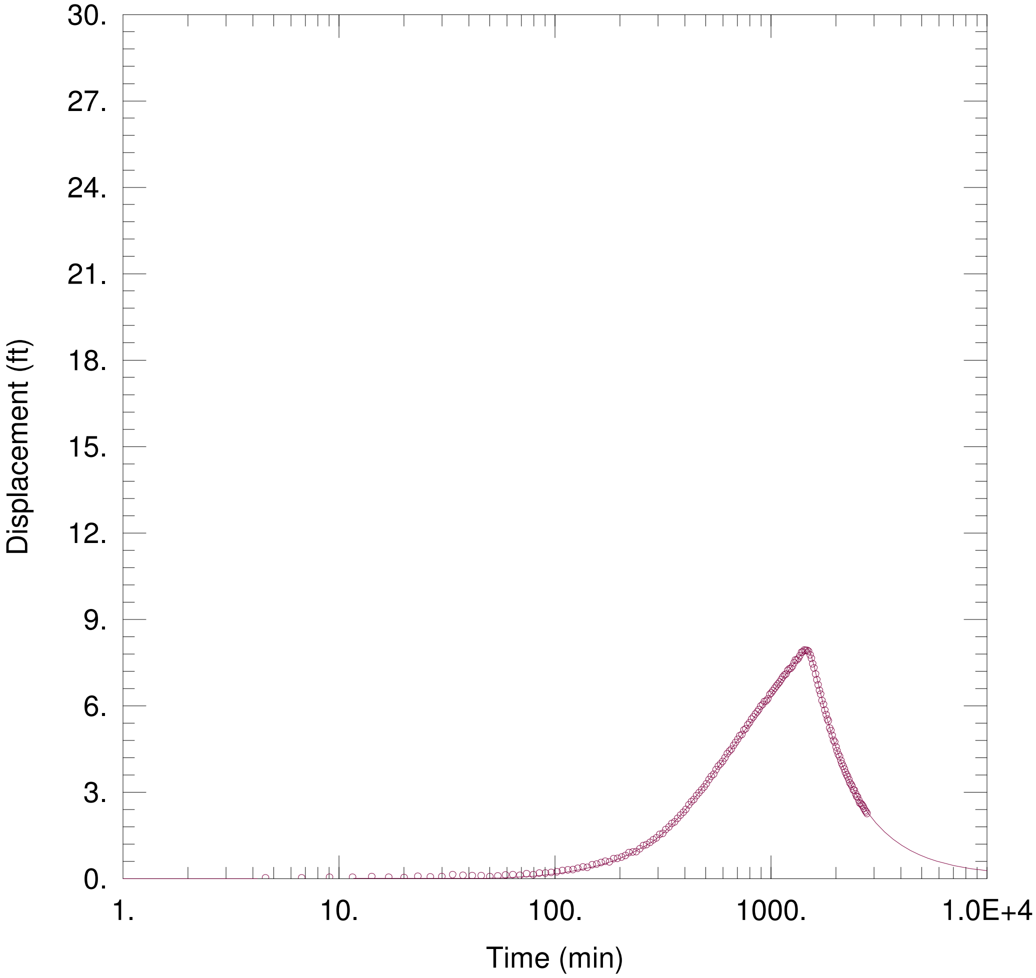
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 285.4 ft^2/day
S = 0.001322
1/B = 2.0E-5 ft^{-1}
ß/r = 0.0004048 ft^{-1}
T2 = 1.44E+8 ft^2/day
S2 = 6.029E-9



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob3d_NW2.aqt
Date: 03/27/19 Time: 16:12:44

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

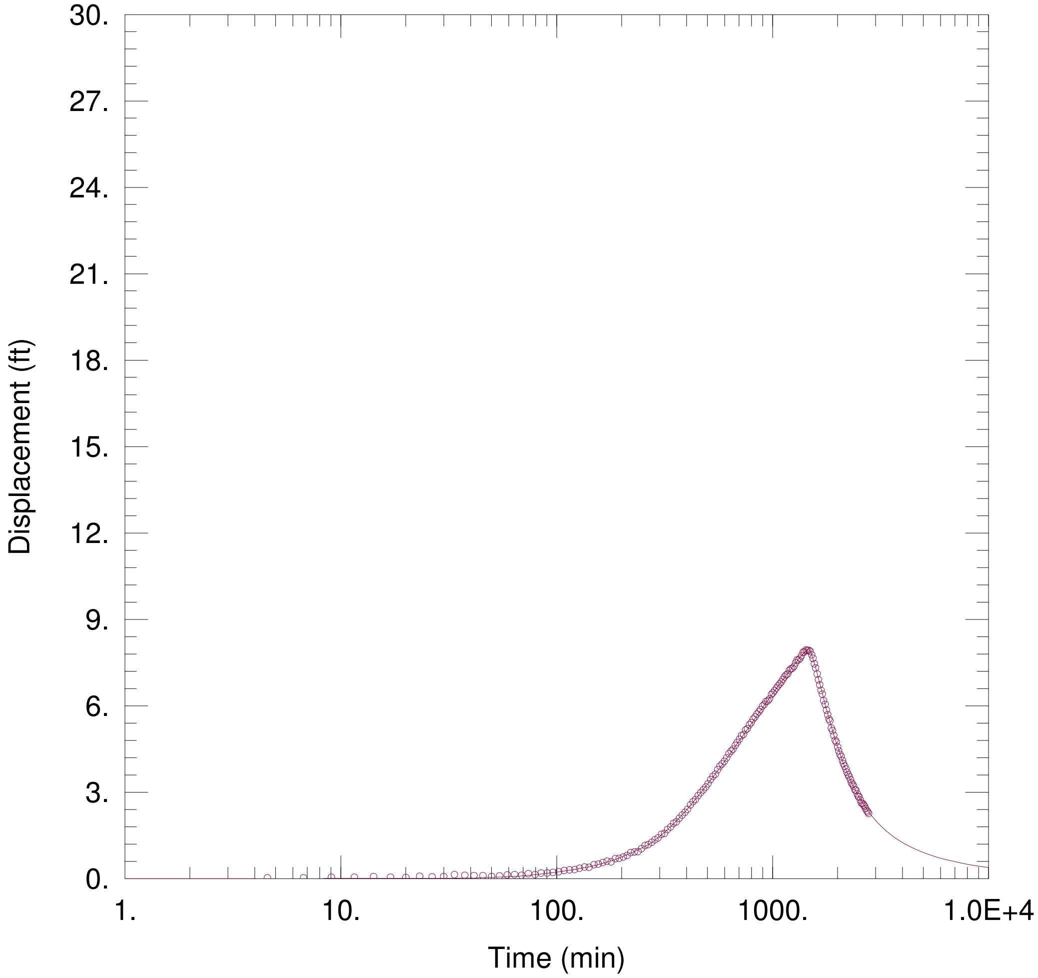
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 211.1 ft^2/day
1/B = 0.002594 ft^{-1}
T2 = 1050.4 ft^2/day
S = 0.001112
ß/r = 0.0007434 ft^{-1}
S2 = 1.0E-10



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob3d_NW3.aqt
Date: 03/27/19 Time: 16:13:15

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

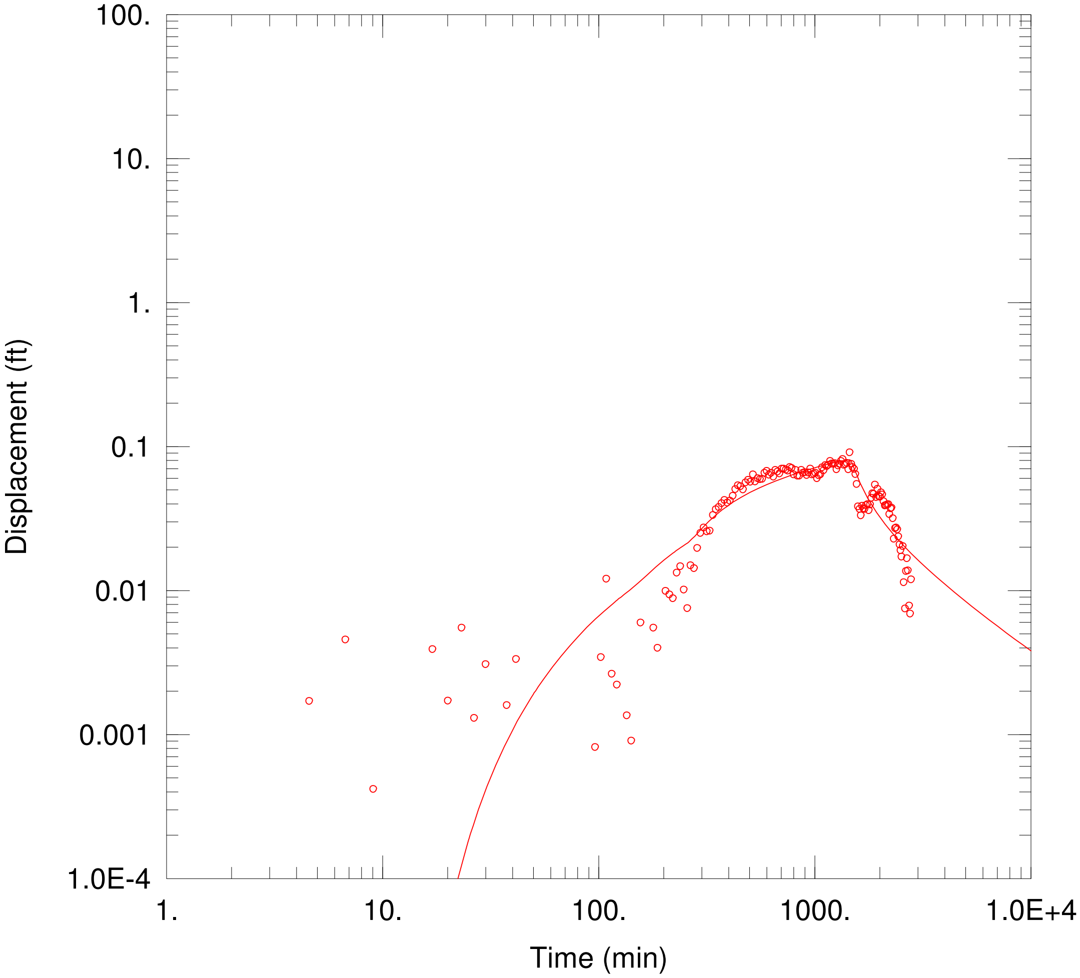
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3d	0	300

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 52.87 ft^2/day
1/B = 0.007383 ft^{-1}
T2 = 671.2 ft^2/day
S = 0.0001383
ß/r = 0.006333 ft^{-1}
S2 = 0.001389



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob3bs_NW.aqt
Date: 03/27/19 Time: 16:11:23

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

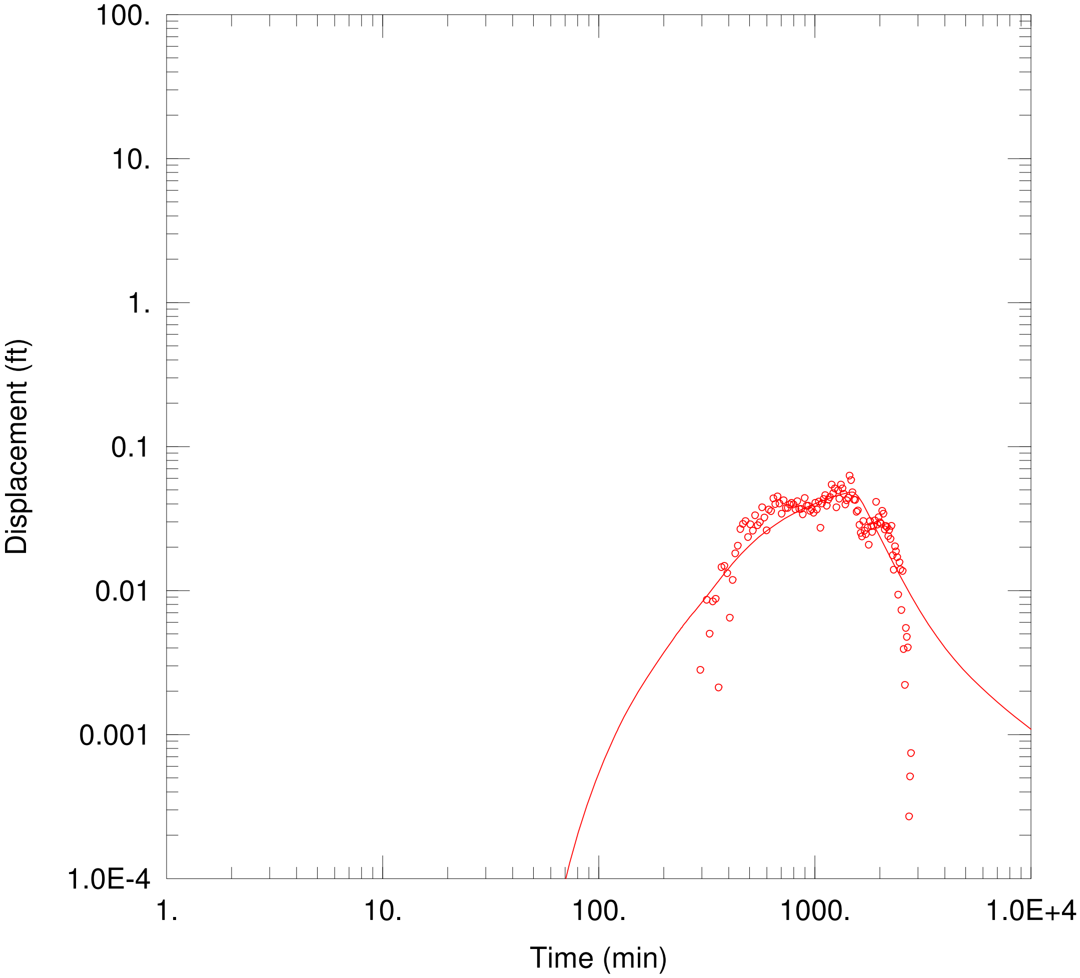
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB3Bs	0	50

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 1.1E+4 ft^2/day
1/B = 0.001675 ft^{-1}
T2 = 5.713E+4 ft^2/day
S = 0.0004231
ß/r = 0.001461 ft^{-1}
S2 = 0.01113



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob4bs_NW.aqt
Date: 03/27/19 Time: 16:13:40

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

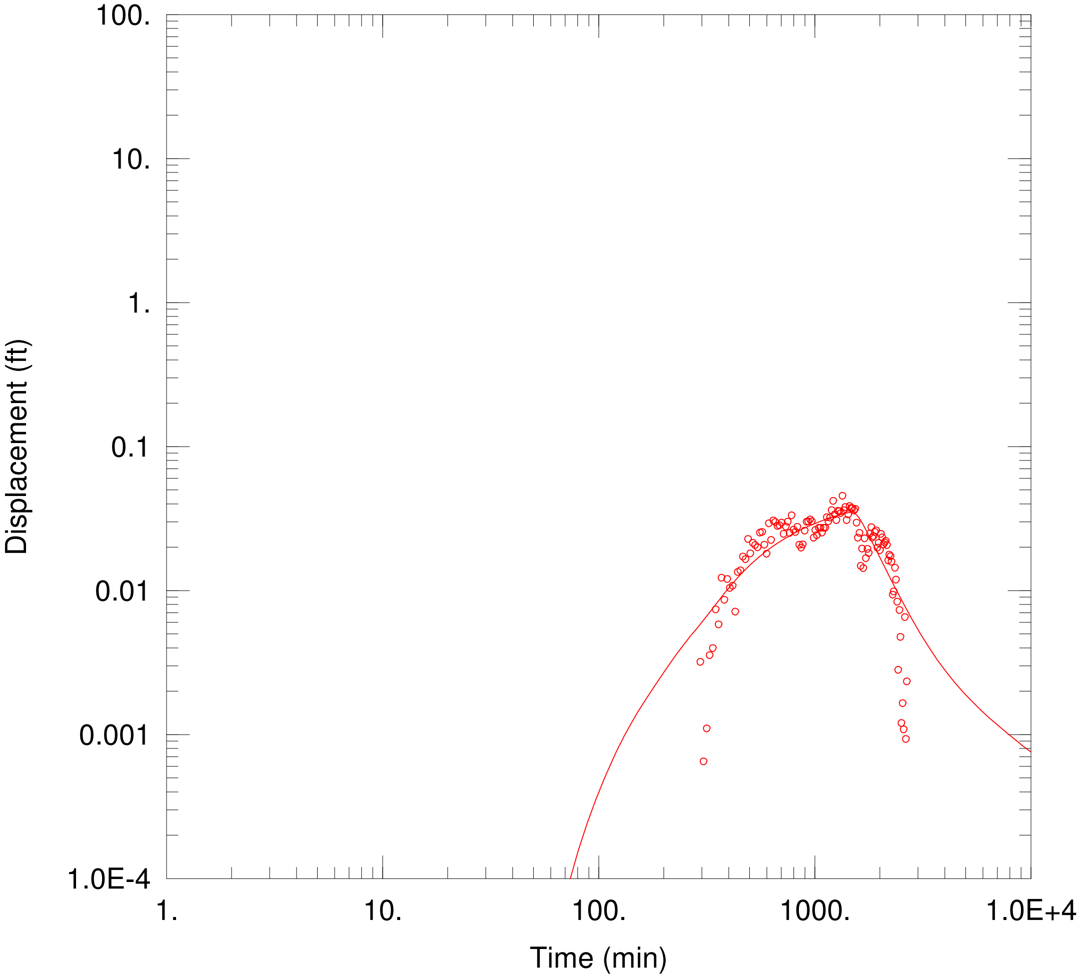
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB4Bs	0	50

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 203.6 ft^2/day
1/B = 0.001029 ft^{-1}
T2 = 2.555E+5 ft^2/day
S = 1.155E-5
ß/r = 0.000962 ft^{-1}
S2 = 1.192E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\1well\PWBob5bs_NW.aqt
Date: 03/27/19 Time: 16:14:07

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

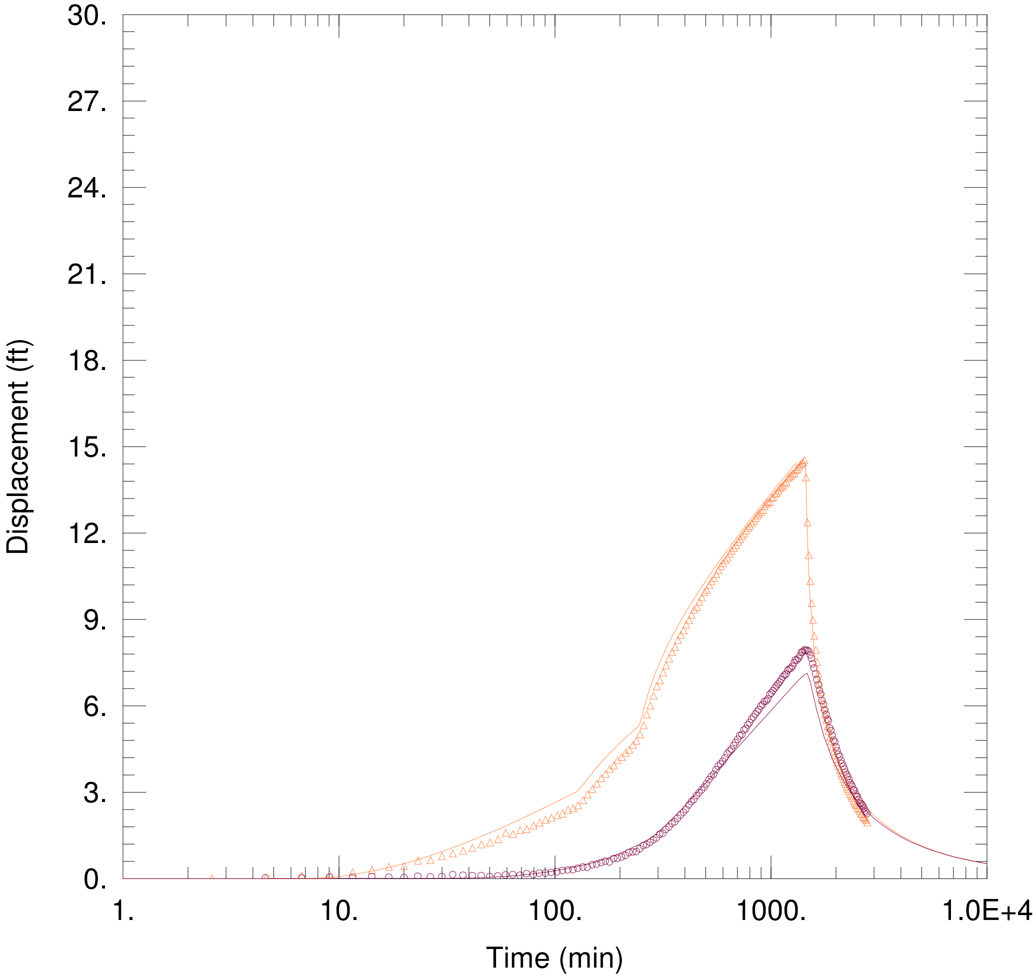
Observation Wells

Well Name	X (ft)	Y (ft)
○ OWB5Bs	0	100

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 206.1 ft^2/day
1/B = 0.0009783 ft^{-1}
T2 = 3.673E+5 ft^2/day
S = 1.155E-5
ß/r = 0.0008631 ft^{-1}
S2 = 1.9E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\2wells\PWBob1d2d.aqt
Date: 04/15/19 Time: 14:20:37

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

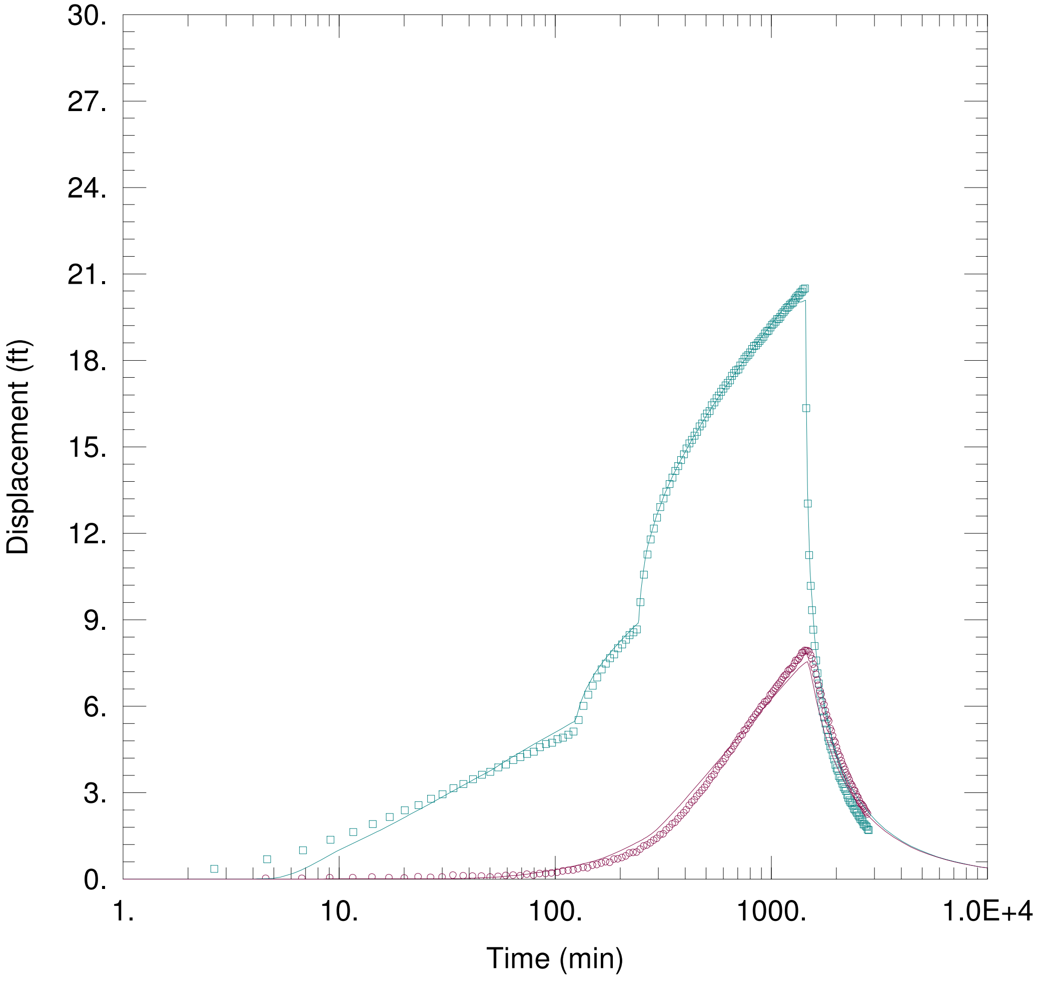
Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2d	0	100
○ OWB3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 960.2 ft^2/day
S = 0.003311
Sy = 0.001
Kz/Kr = 1.033E-5



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\2wells\PWBob1d3d.aqt
Date: 04/15/19 Time: 14:22:02

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

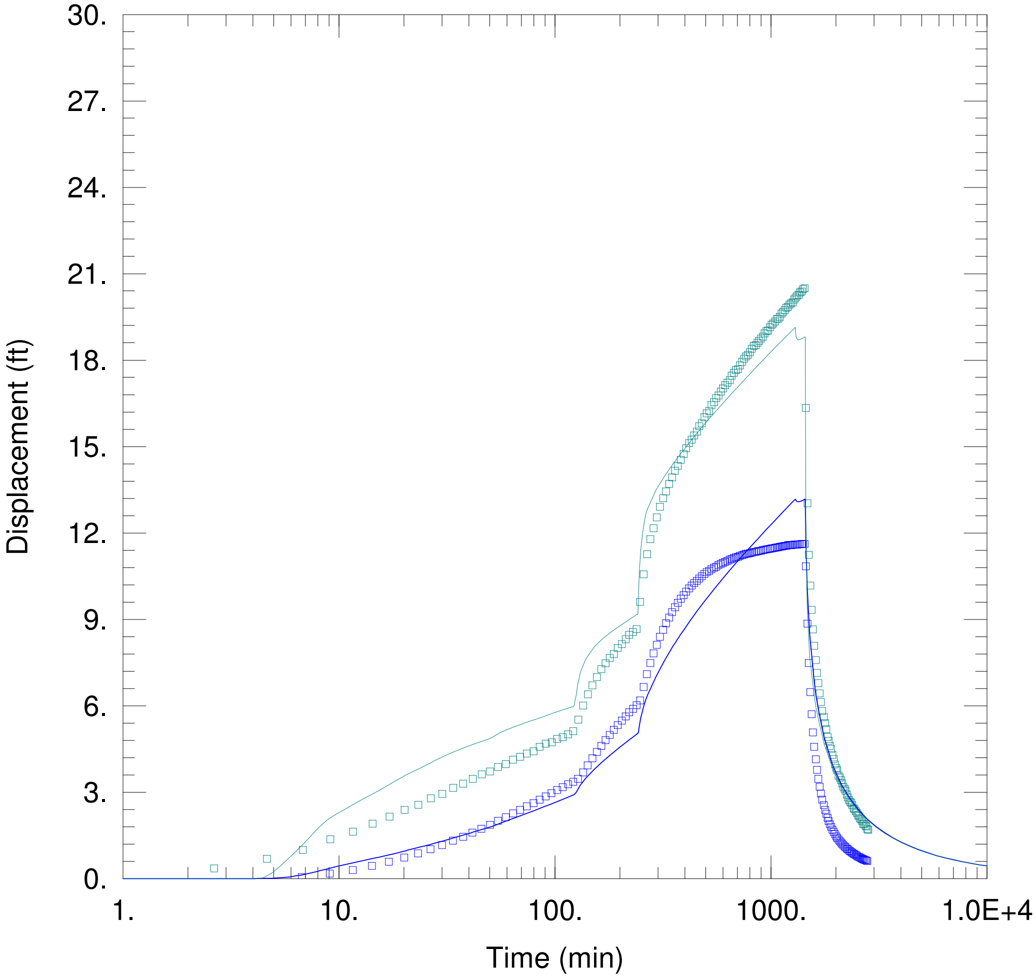
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1d	0	50
○ OWB3d	0	300

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 924.1 ft^2/day
Sy = 0.25
S = 0.003009
Kz/Kr = 0.0003728



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\2wells\PWBob1.aqt
Date: 04/15/19 Time: 14:14:54

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1s	0	50
□ OWB1d	0	50

SOLUTION

Aquifer Model: Unconfined

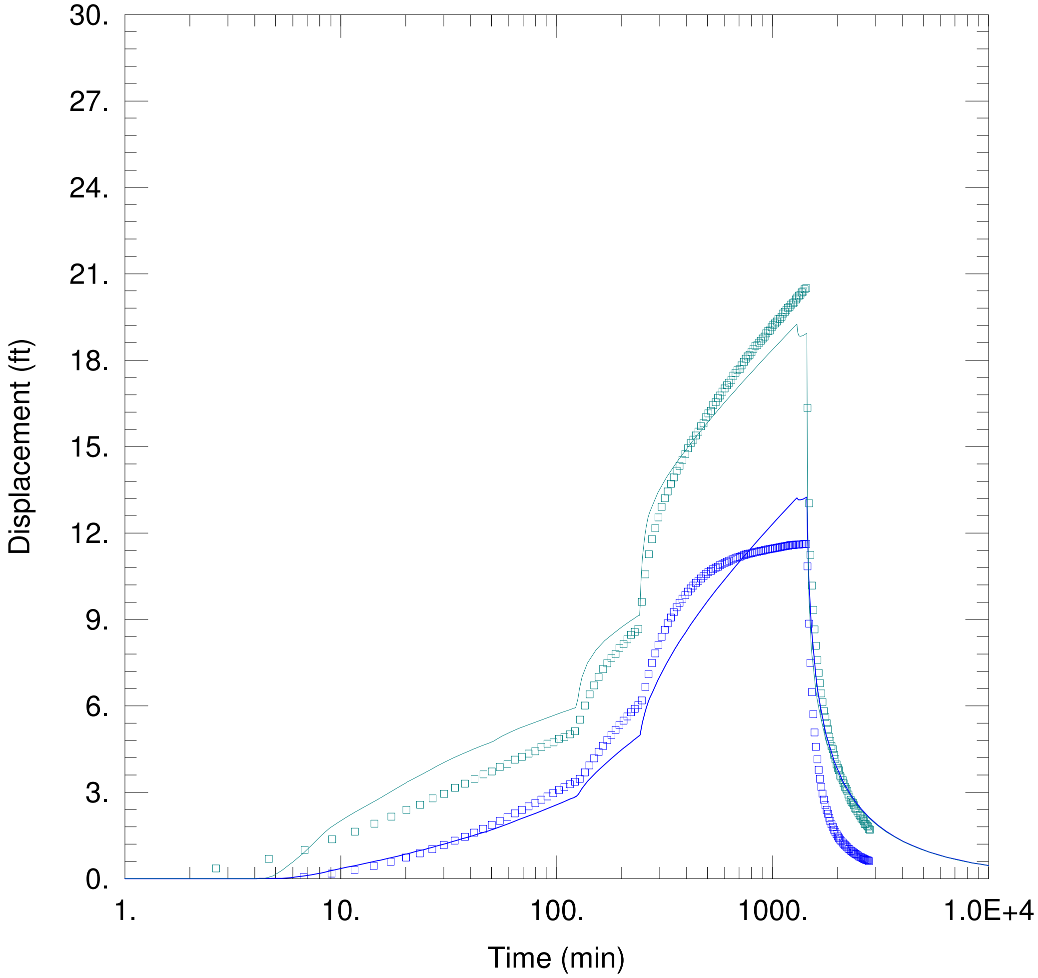
Solution Method: Neuman

T = 593.1 ft^2/day

Sy = 0.001

S = 0.001002

Kz/Kr = 0.2921



WELL TEST ANALYSIS

Data Set: H:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\unconf\2wells\PWBob1alt.aqt
Date: 04/15/19 Time: 14:17:49

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 115. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-B	0	0

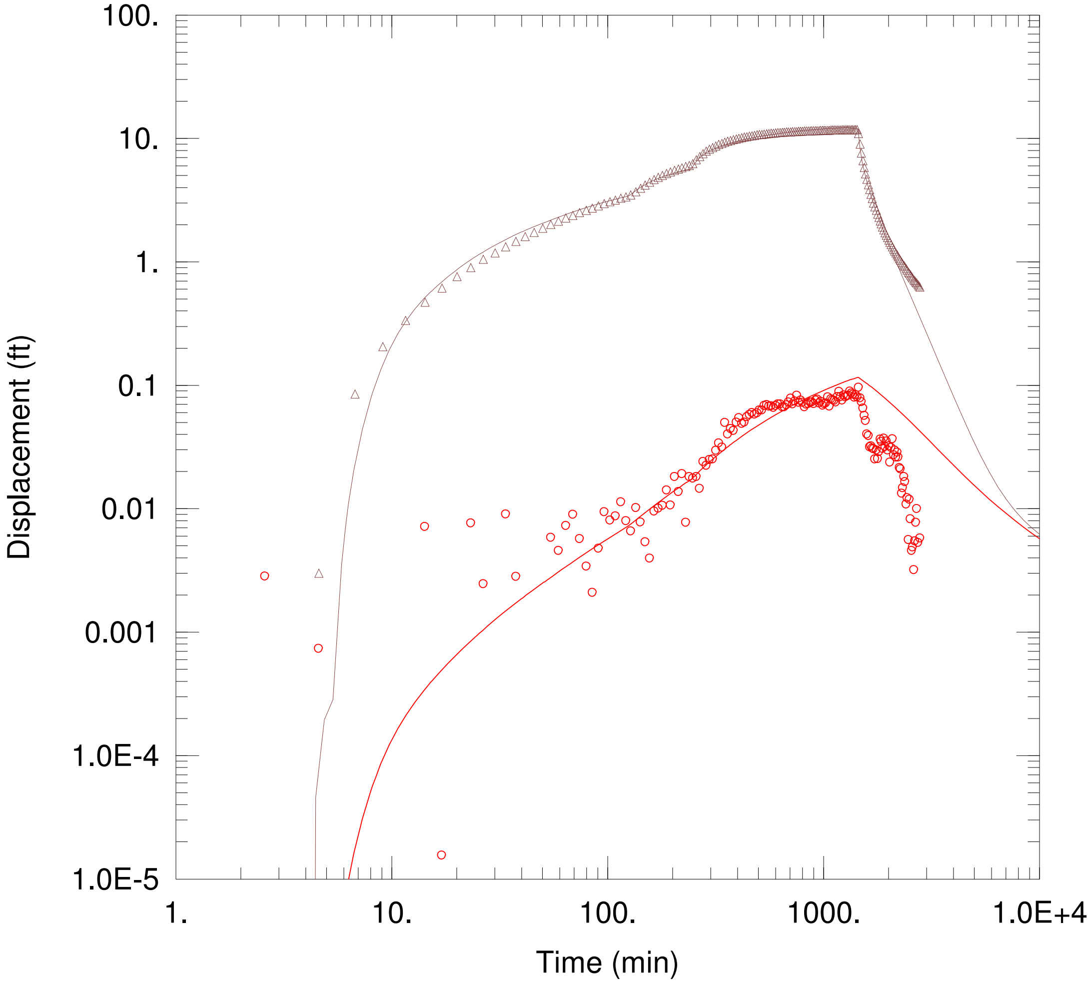
Observation Wells

Well Name	X (ft)	Y (ft)
□ OWB1s	0	50
□ OWB1d	0	50

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 575.2 ft^2/day
Sy = 0.001
S = 0.001228
Kz/Kr = 0.3018



WELL TEST ANALYSIS

Data Set: M:\2018033.00 TTL Twin Pines\Aquifer Tests\PWB\leaky\2wells\PWBob2bs_NW.aqt
Date: 03/28/19 Time: 13:39:04

PROJECT INFORMATION

Company: HGC
Client: TTL
Test Well: PW-B

AQUIFER DATA

Saturated Thickness: 100. ft
Aquitard Thickness (b'): 10. ft
Anisotropy Ratio (Kz/Kr): 0.1804
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
△ OWB2s	0	100
○ OWB2Bs	0	100

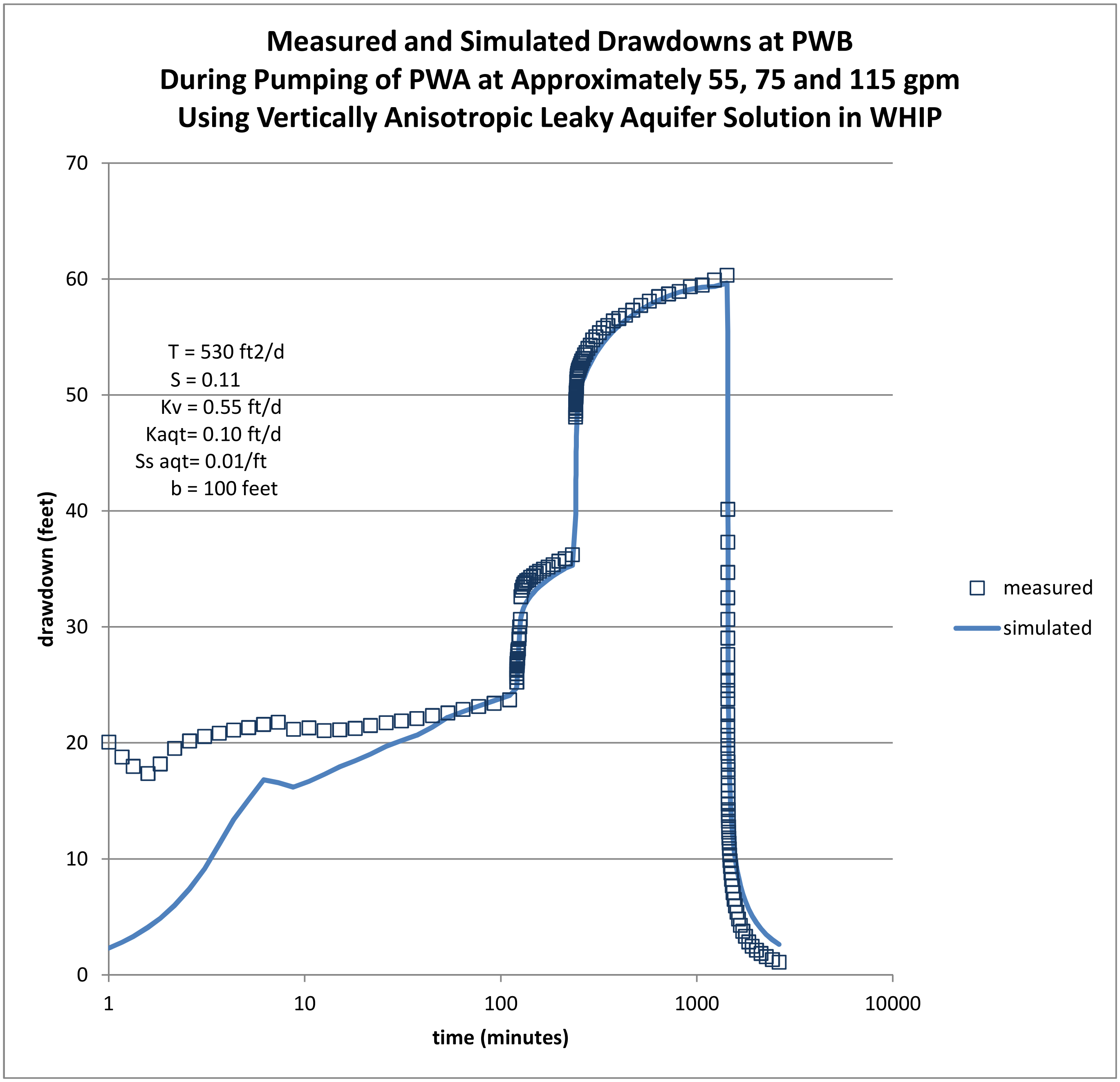
SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

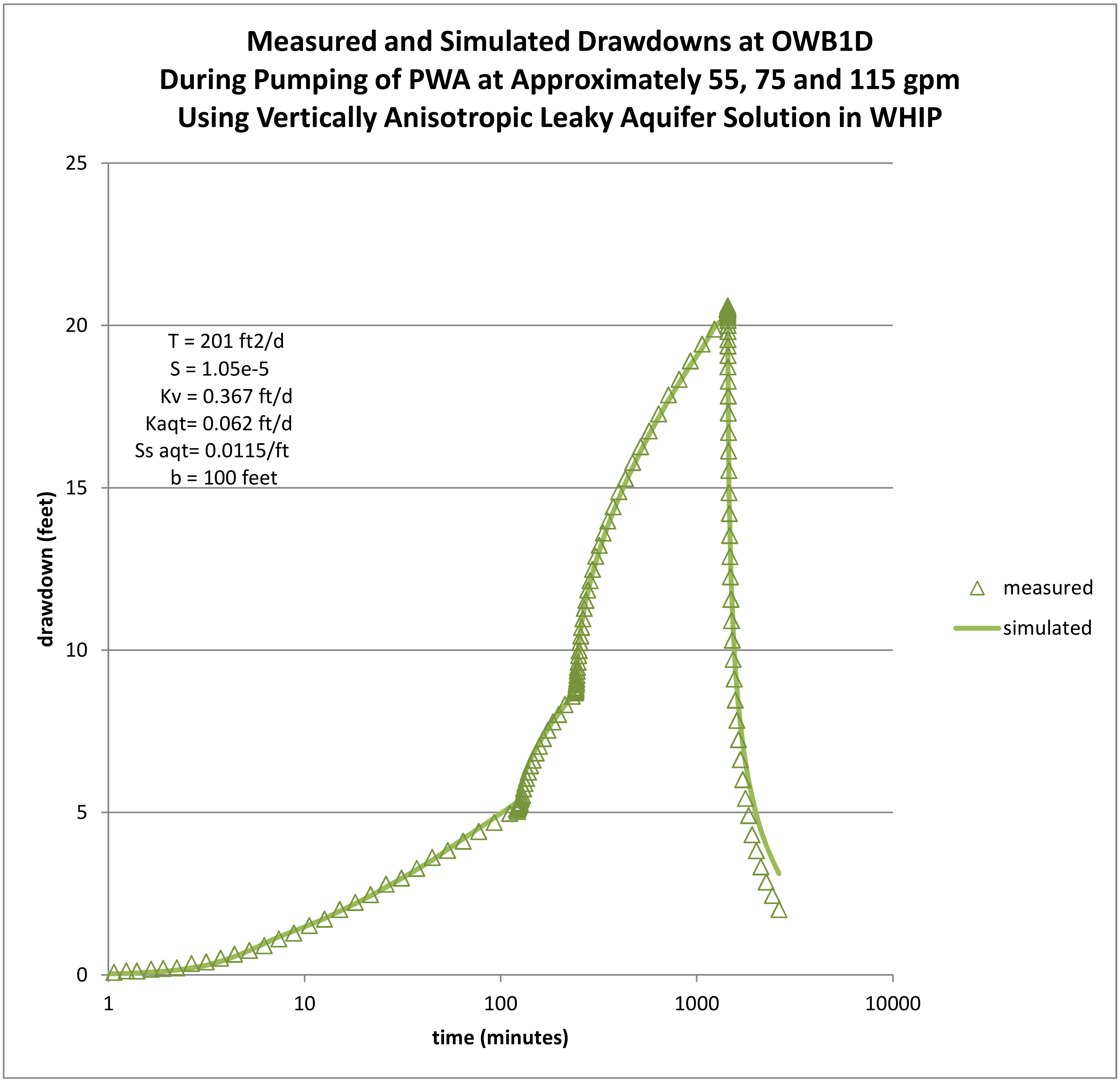
T = 516.8 ft^2/day
1/B = 0.001867 ft^{-1}
T2 = 5.028E+4 ft^2/day
S = 0.001132
ß/r = 5.261E-5 ft^{-1}
S2 = 0.002588

APPENDIX E

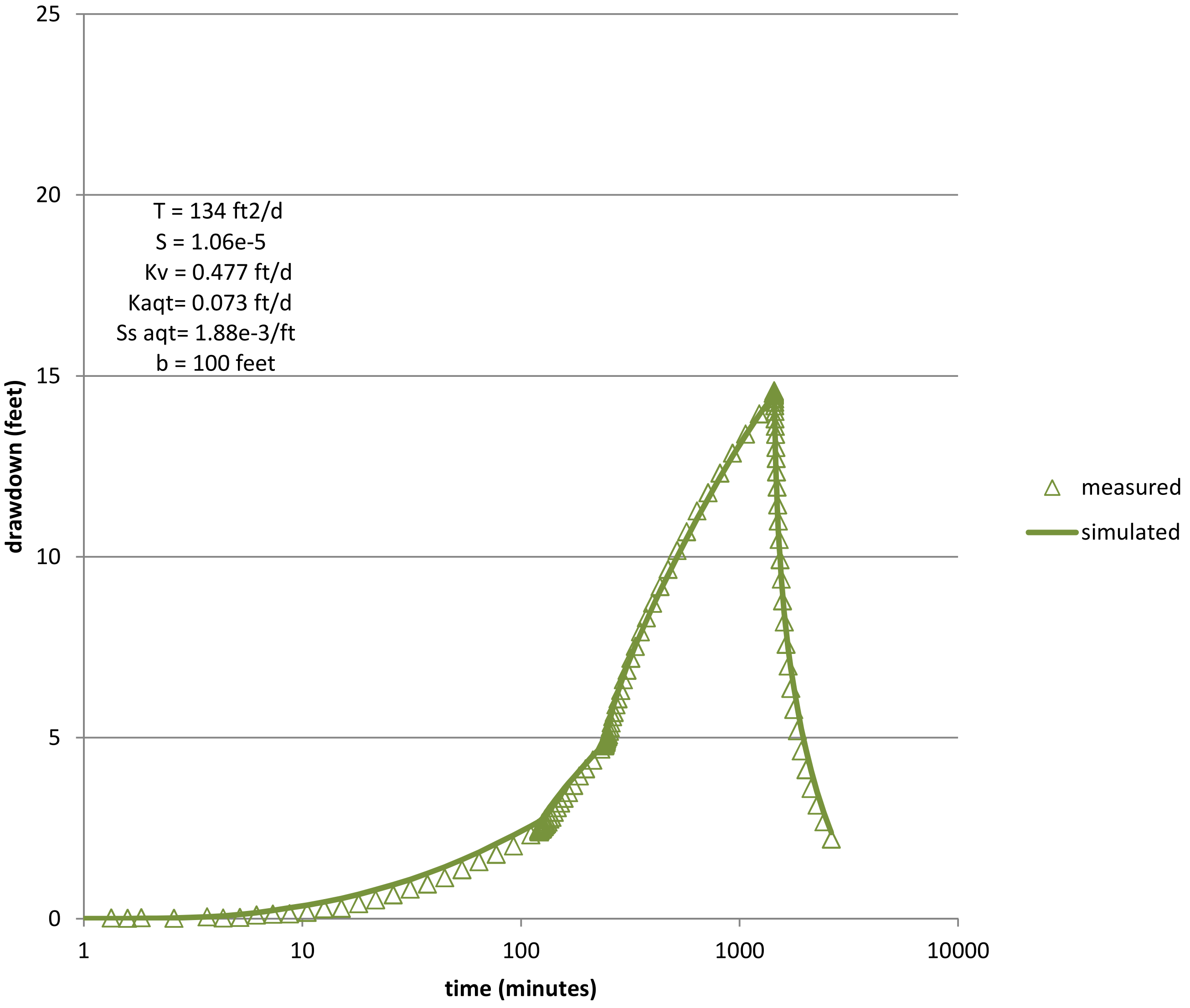
WHIP PWB TEST PLOTS

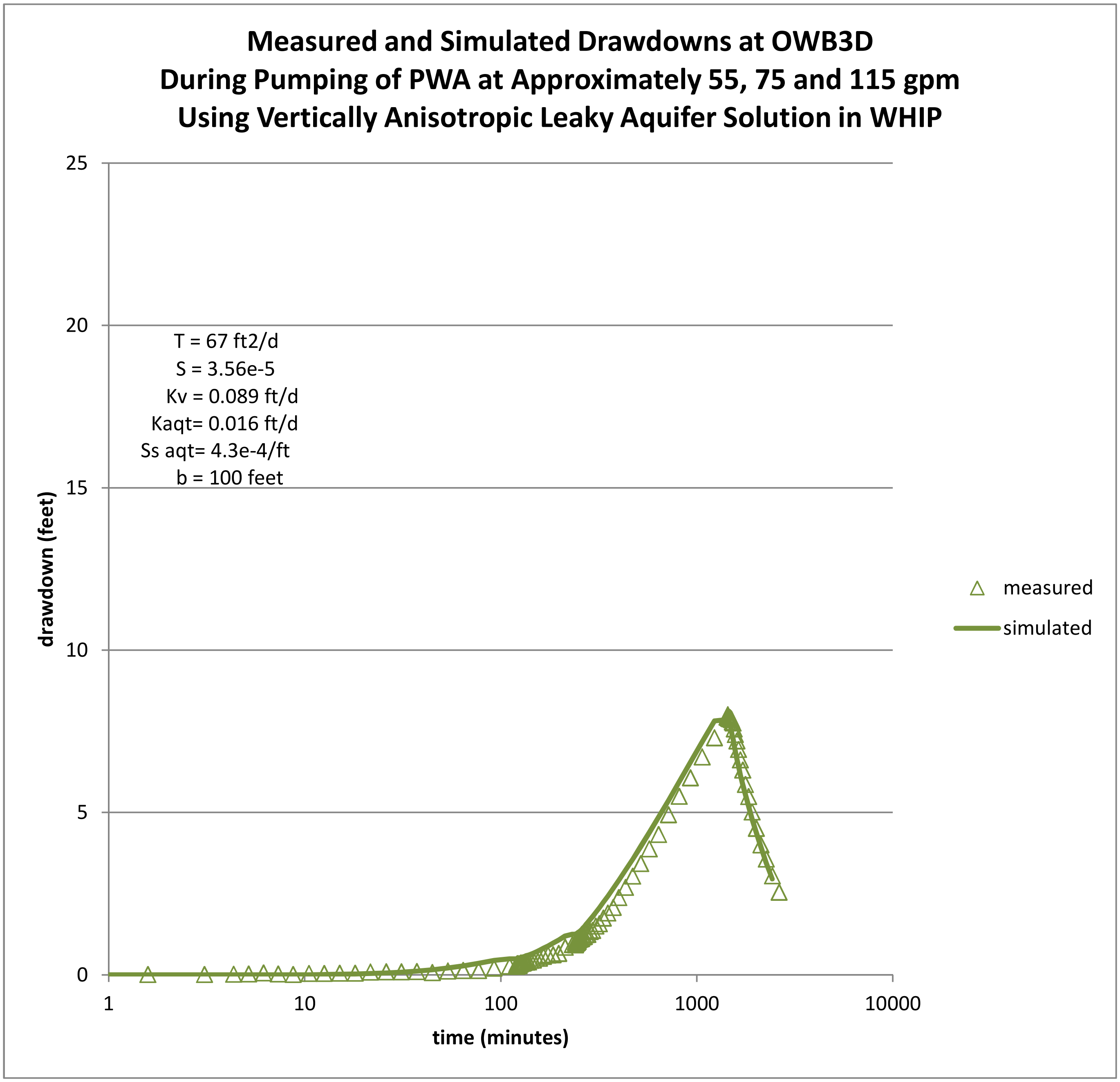


Measured and Simulated Drawdowns at PWB
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

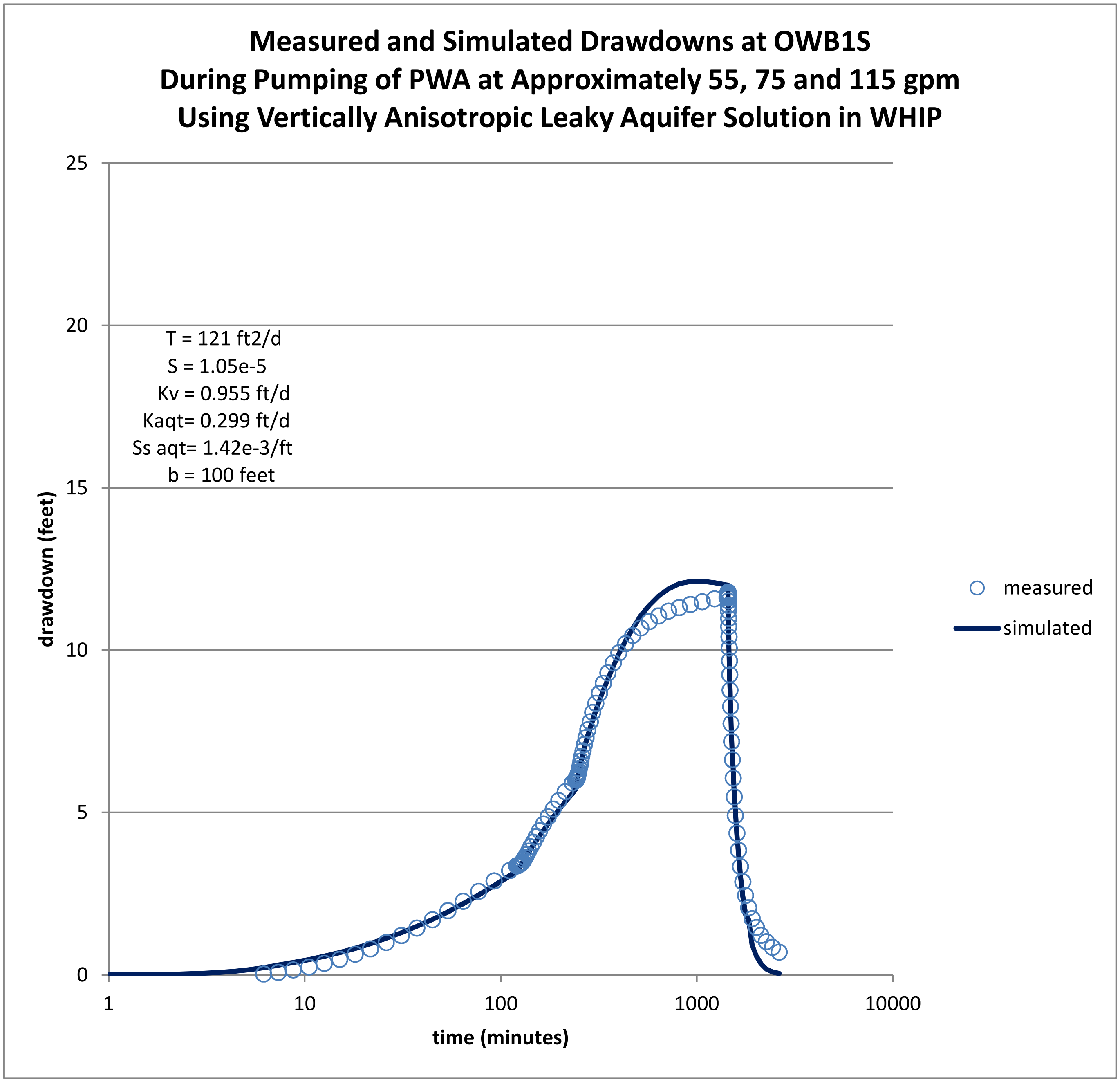

Measured and Simulated Drawdowns at OWB1D
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 201 ft2/d
S = 1.05e-5
Kv = 0.367 ft/d
Kaqt= 0.062 ft/d
Ss aqt= 0.0115/ft
b = 100 feet
25
20
15
10
5
0
1
10
100
1000
10000
drawdown (feet)
time (minutes)
measured
simulated

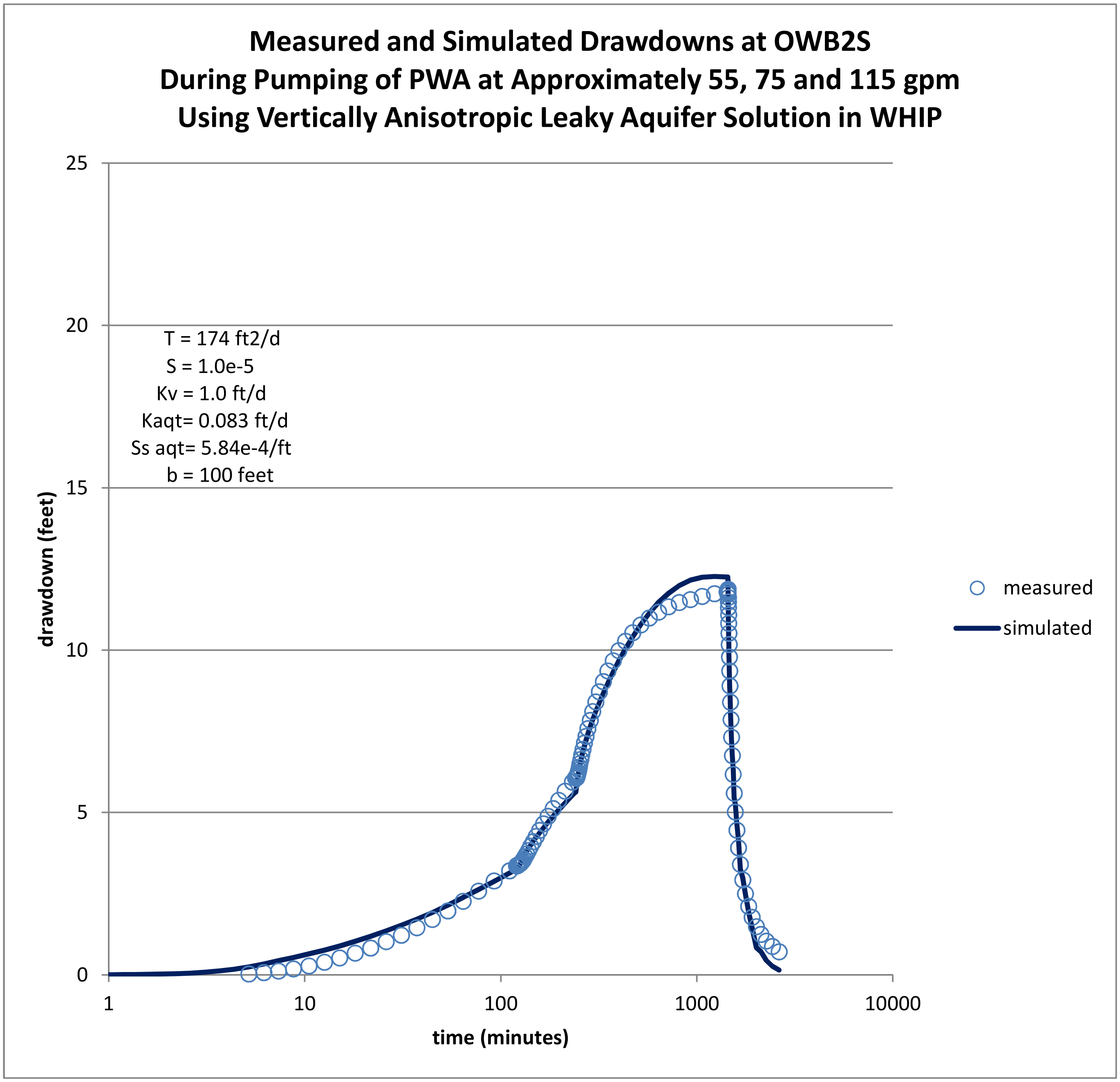
Measured and Simulated Drawdowns at OWB2D
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP





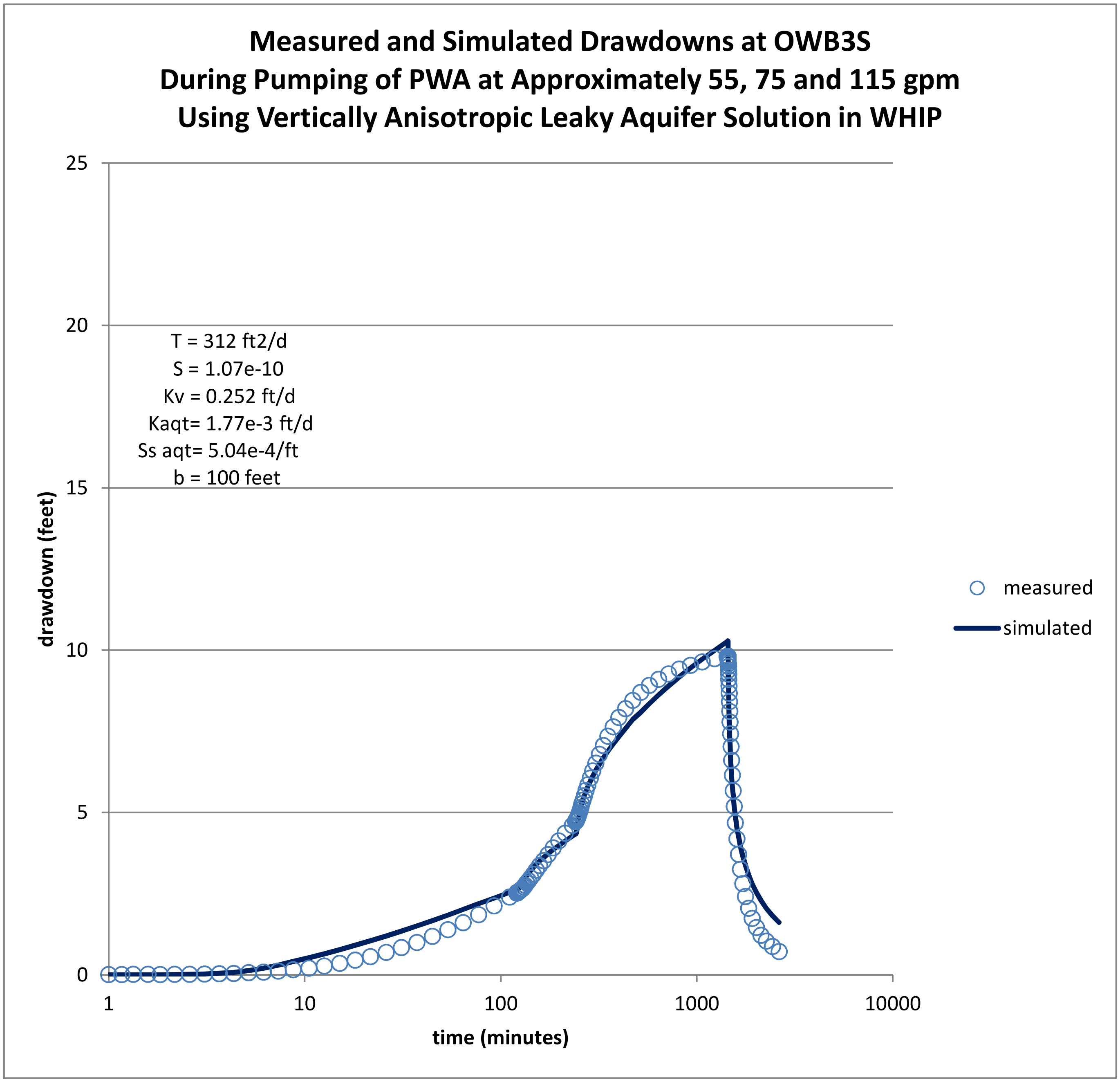
Measured and Simulated Drawdowns at OWB3D
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

Measured and Simulated Drawdowns at OWB1S
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 121 ft2/d
S = 1.05e-5
Kv = 0.955 ft/d
Kaqt= 0.299 ft/d
Ss aqt= 1.42e-3/ft
b = 100 feet
drawdown (feet)
25
20
15
10
5
0
1
10
100
1000
10000
time (minutes)
measured
simulated



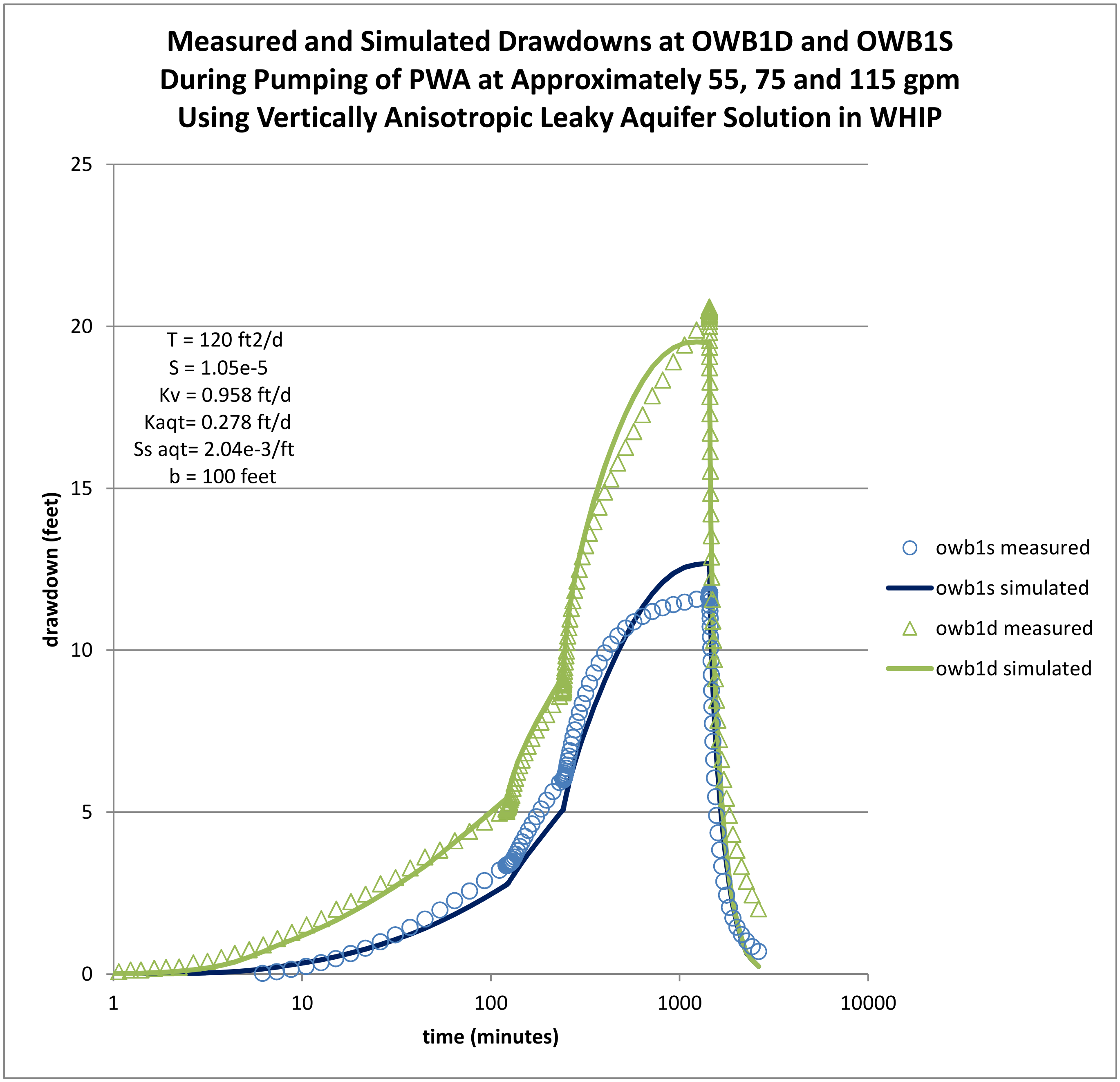
Measured and Simulated Drawdowns at OWB2S
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

T = 174 ft2/d
S = 1.0e-5
Kv = 1.0 ft/d
Kaqt= 0.083 ft/d
Ss aqt= 5.84e-4/ft
b = 100 feet



Measured and Simulated Drawdowns at OWB3S
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP

T = 312 ft2/d
S = 1.07e-10
Kv = 0.252 ft/d
Kaqt= 1.77e-3 ft/d
Ss aqt= 5.04e-4/ft
b = 100 feet

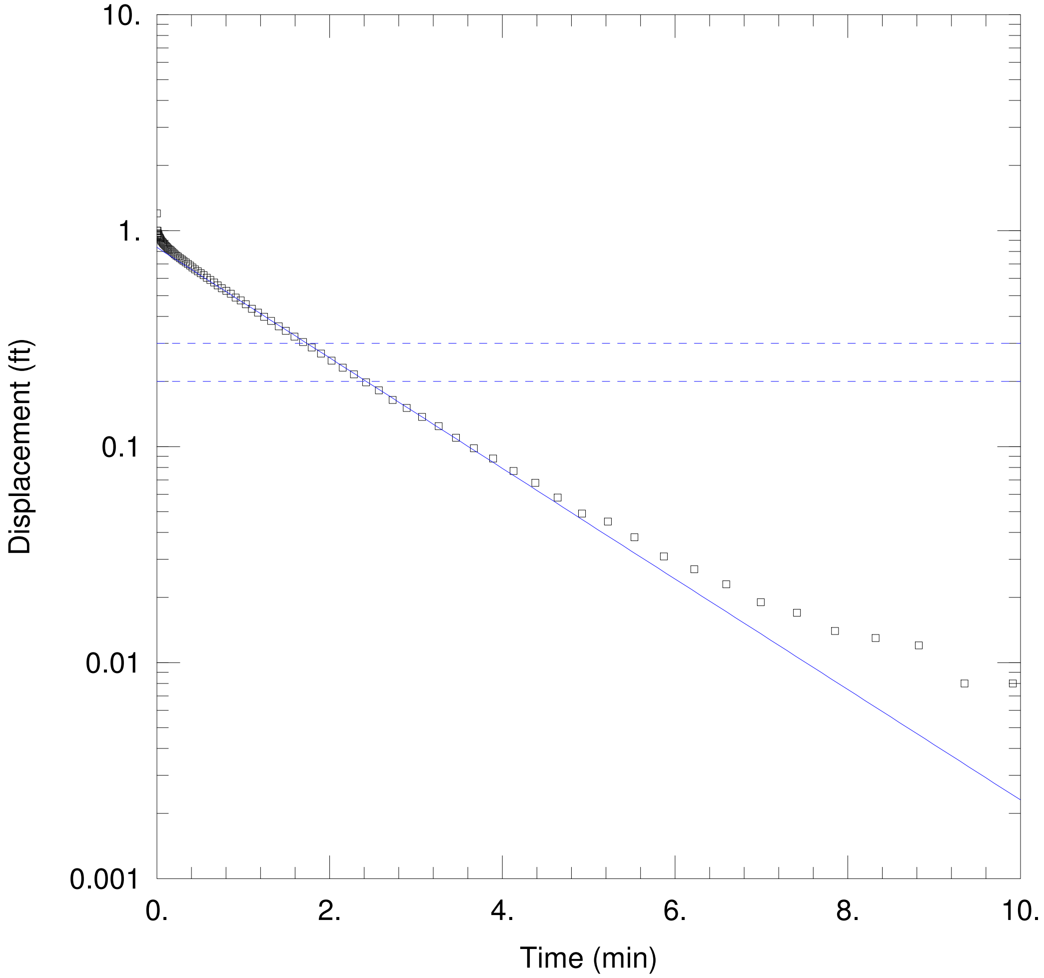


Measured and Simulated Drawdowns at OWB1D and OWB1S
During Pumping of PWA at Approximately 55, 75 and 115 gpm
Using Vertically Anisotropic Leaky Aquifer Solution in WHIP
T = 120 ft2/d
S = 1.05e-5
Kv = 0.958 ft/d
Kaqt= 0.278 ft/d
Ss aqt= 2.04e-3/ft
b = 100 feet
drawdown (feet)
0
5
10
15
20
25
time (minutes)
1
10
100
1000
10000
owb1s measured
owb1s simulated
owb1d measured
owb1d simulated

APPENDIX C

Attached Documents:
Slug and Bail Test Interpretations

SLUG AND BAIL TEST INTERPRETATIONS



WELL TEST ANALYSIS

Data Set: H:\...\PZ01 BAIL_SJS_BR_rev.aqt
Date: 07/10/19
Time: 12:56:15

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ01 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 0.1

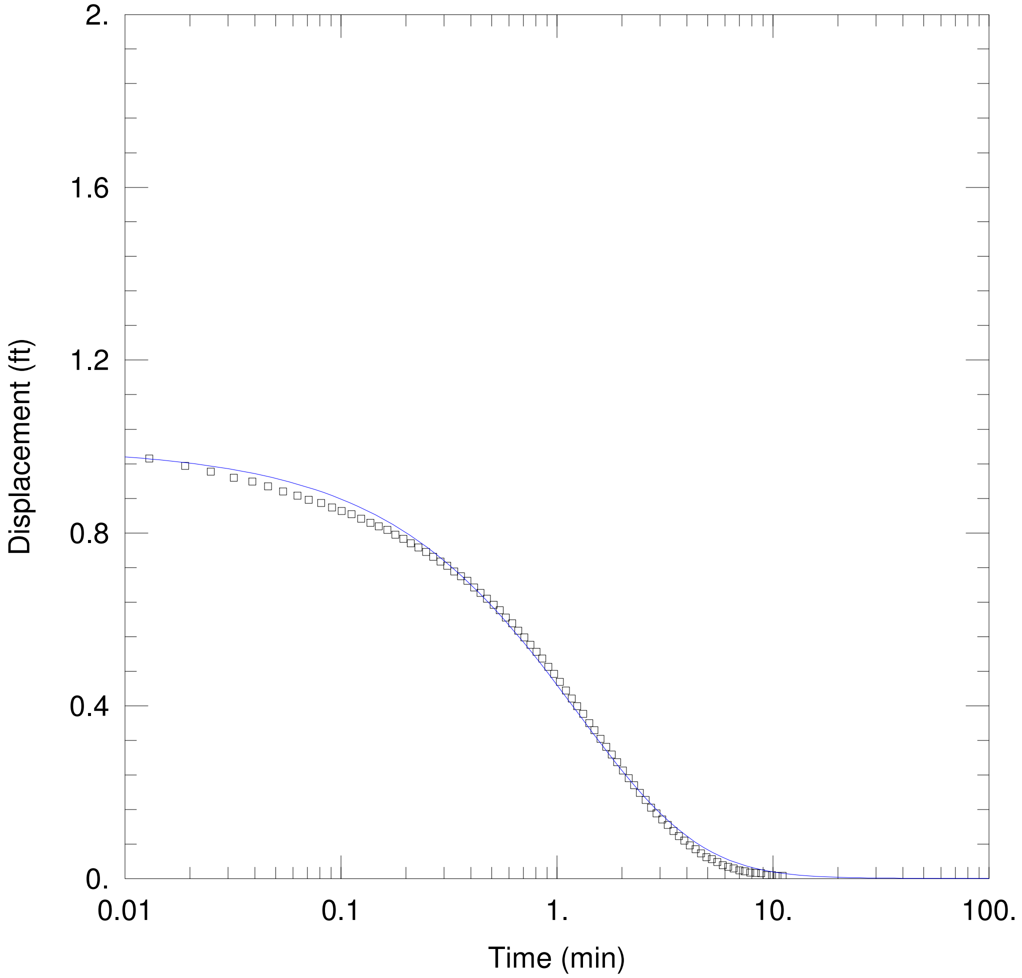
WELL DATA (PZ01 BAIL)

Initial Displacement: 1. ft
Static Water Column Height: 12.18 ft
Total Well Penetration Depth: 12.18 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.9818 ft/day
y0 = 0.8352 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ01 BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 12:57:07

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ01 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 77. ft

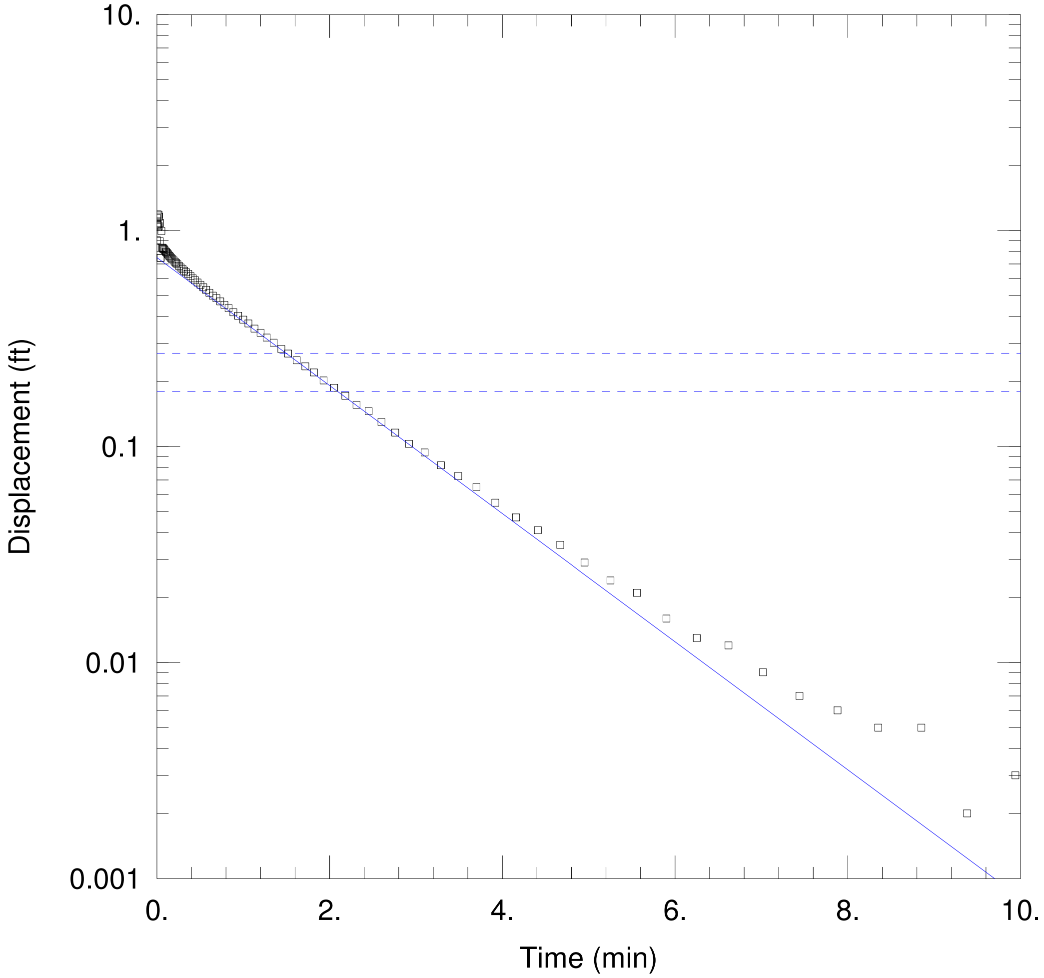
WELL DATA (PZ01 BAIL)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12.18 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.18 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.236 ft/day
Kz/Kr = 0.1
Ss = 3.278E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ01 SLUG_SJS_BR_rev.aqt
Date: 07/10/19 Time: 12:57:27

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ01 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 0.1

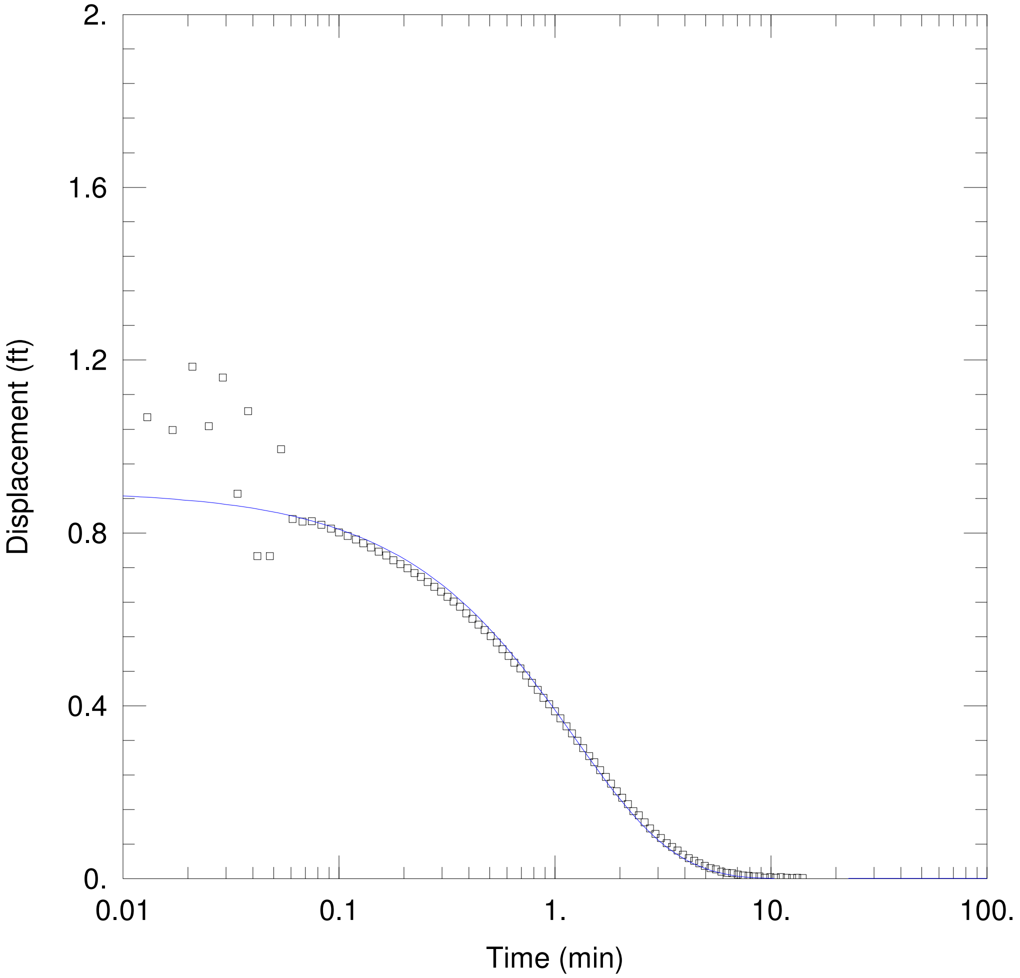
WELL DATA (PZ01 SLUG)

Initial Displacement: 0.9 ft
Static Water Column Height: 12.18 ft
Total Well Penetration Depth: 12.18 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.138 ft/day
y0 = 0.7508 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ01 SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 12:57:45

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ01 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 77. ft

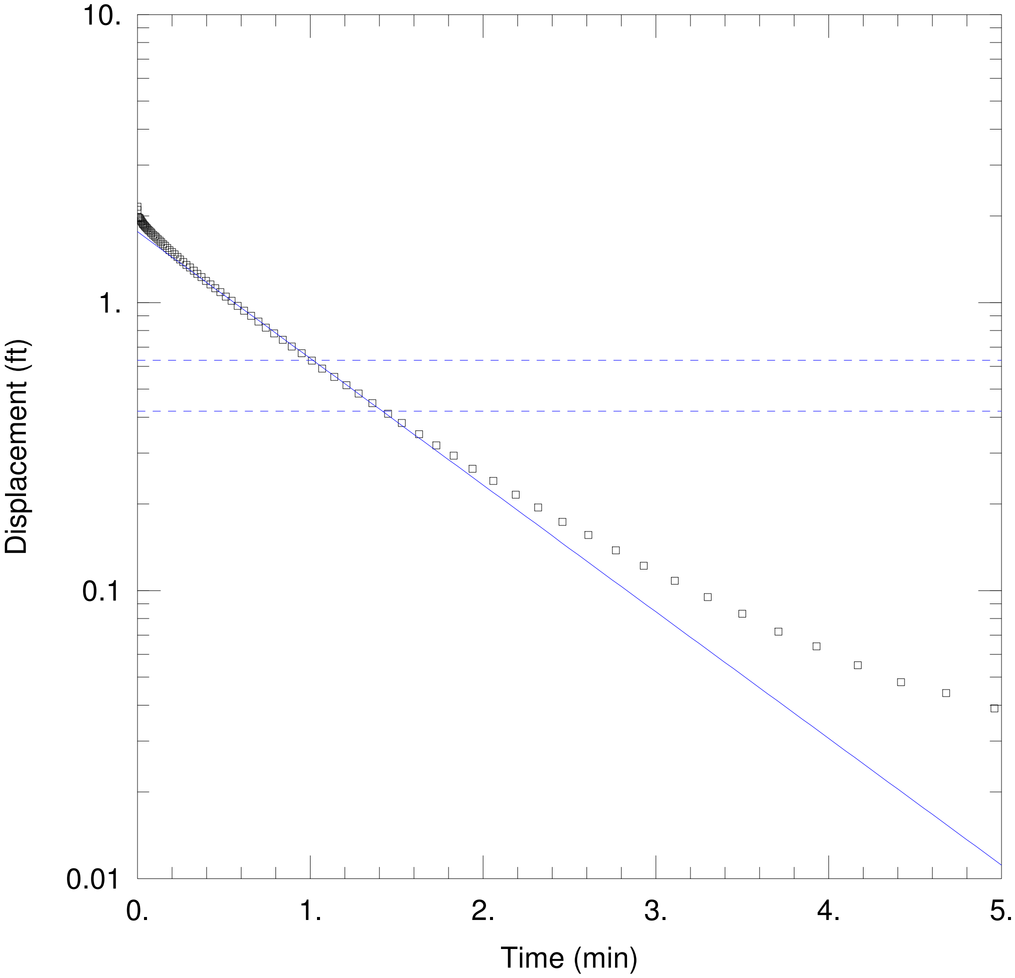
WELL DATA (PZ01 SLUG)

Initial Displacement: 0.9 ft
Total Well Penetration Depth: 12.18 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.18 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.645 ft/day
Kz/Kr = 0.1
Ss = 2.606E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ04 BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 12:58:02

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ04 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft
Anisotropy Ratio (Kz/Kr): 0.1

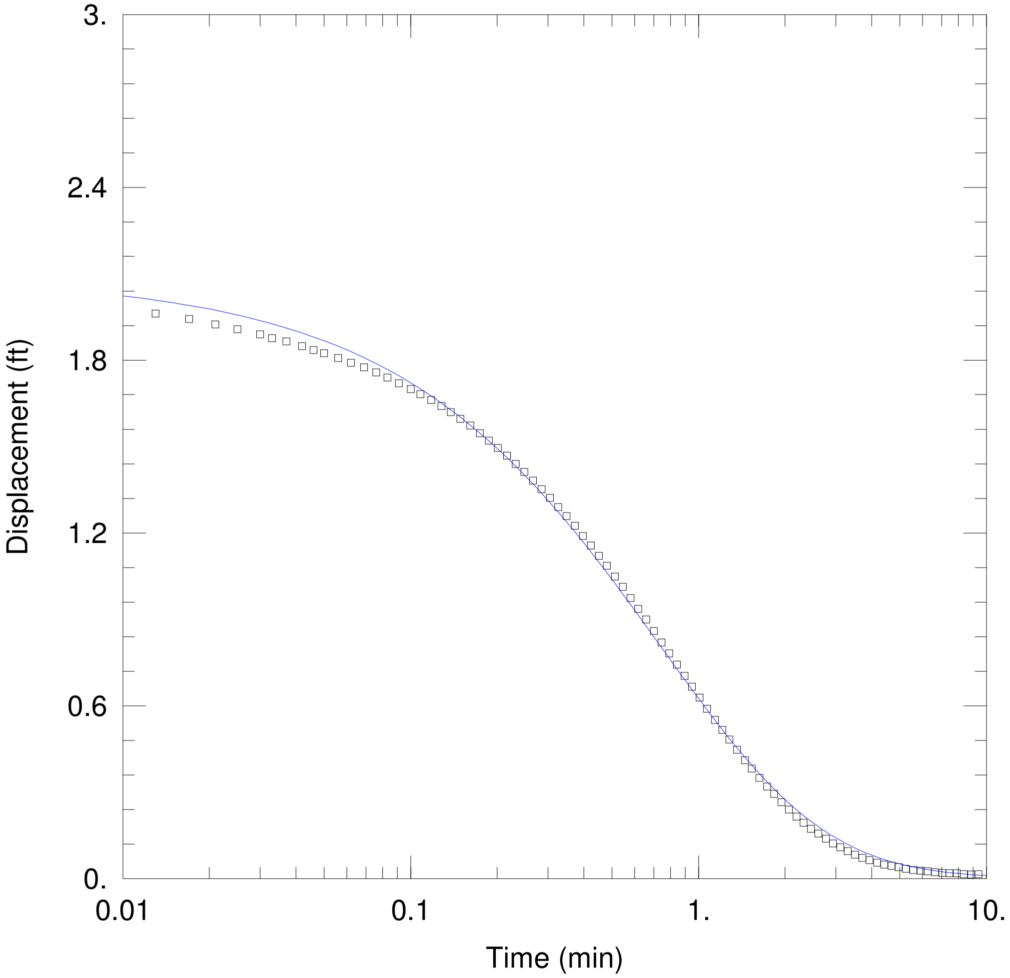
WELL DATA (PZ04 BAIL)

Initial Displacement: 2.1 ft
Static Water Column Height: 10.88 ft
Total Well Penetration Depth: 10.88 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.66 ft/day
y0 = 1.76 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ04 BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 12:58:17

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ04 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft

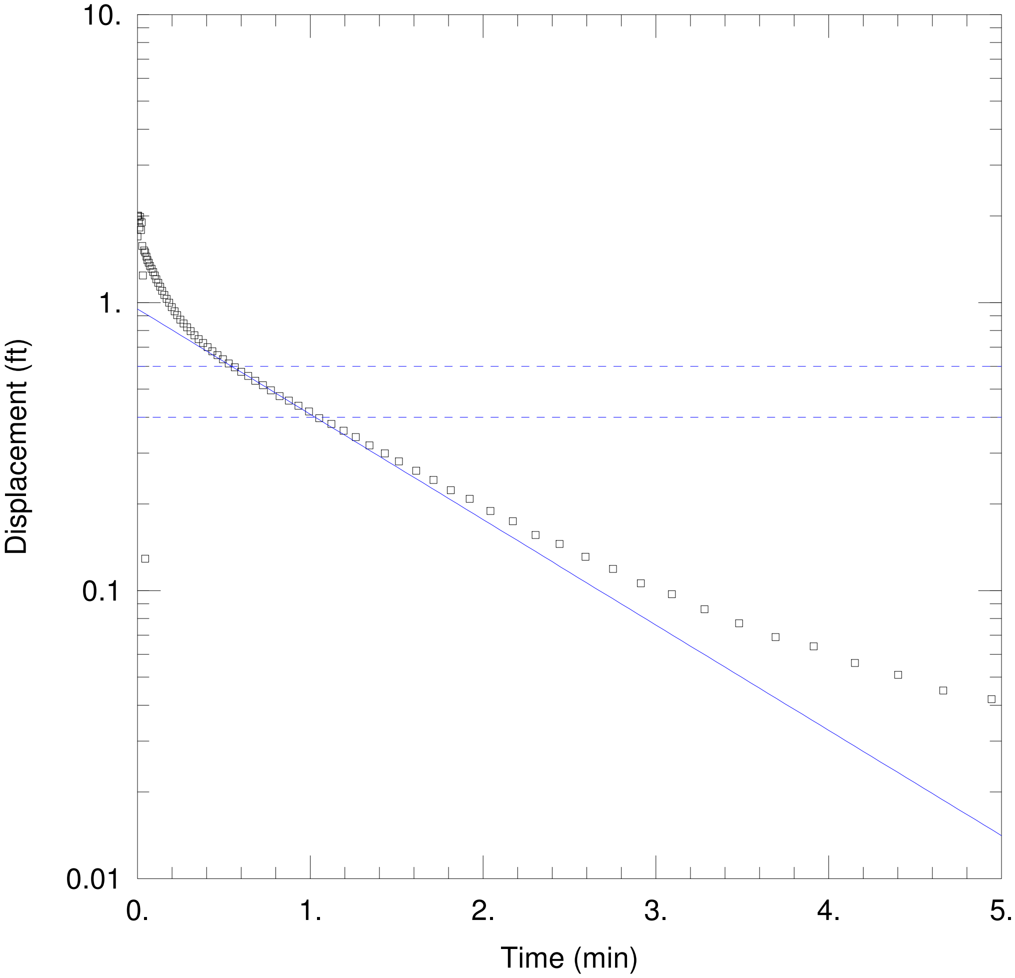
WELL DATA (PZ04 BAIL)

Initial Displacement: 2.1 ft
Total Well Penetration Depth: 10.88 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.88 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.996 ft/day
Kz/Kr = 0.1
Ss = 4.415E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ04 SLUG_SJS_BR_rev.aqt
Date: 07/10/19
Time: 12:58:38

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ04SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft
Anisotropy Ratio (Kz/Kr): 0.1

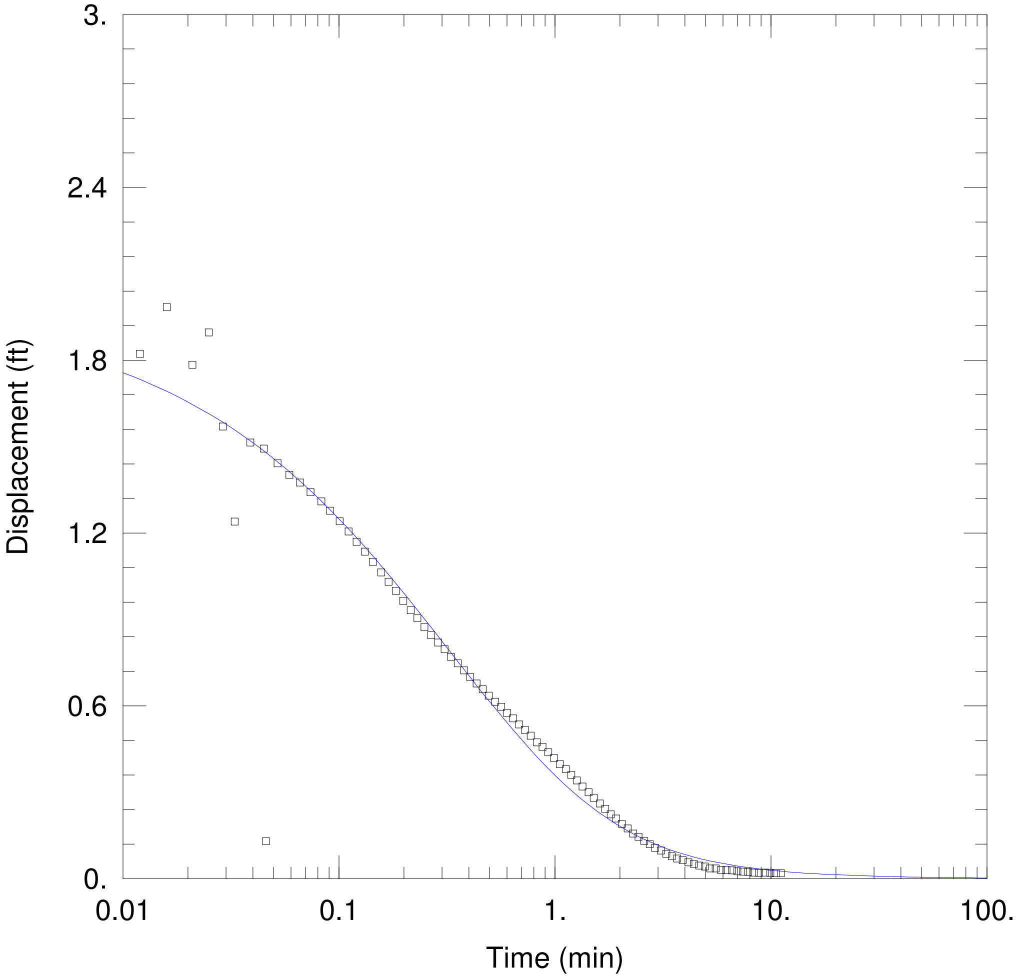
WELL DATA (PZ04 SLUG)

Initial Displacement: 2. ft
Static Water Column Height: 10.88 ft
Total Well Penetration Depth: 10.88 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.381 ft/day
y0 = 0.95 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ04 SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 12:59:00

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ04SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft

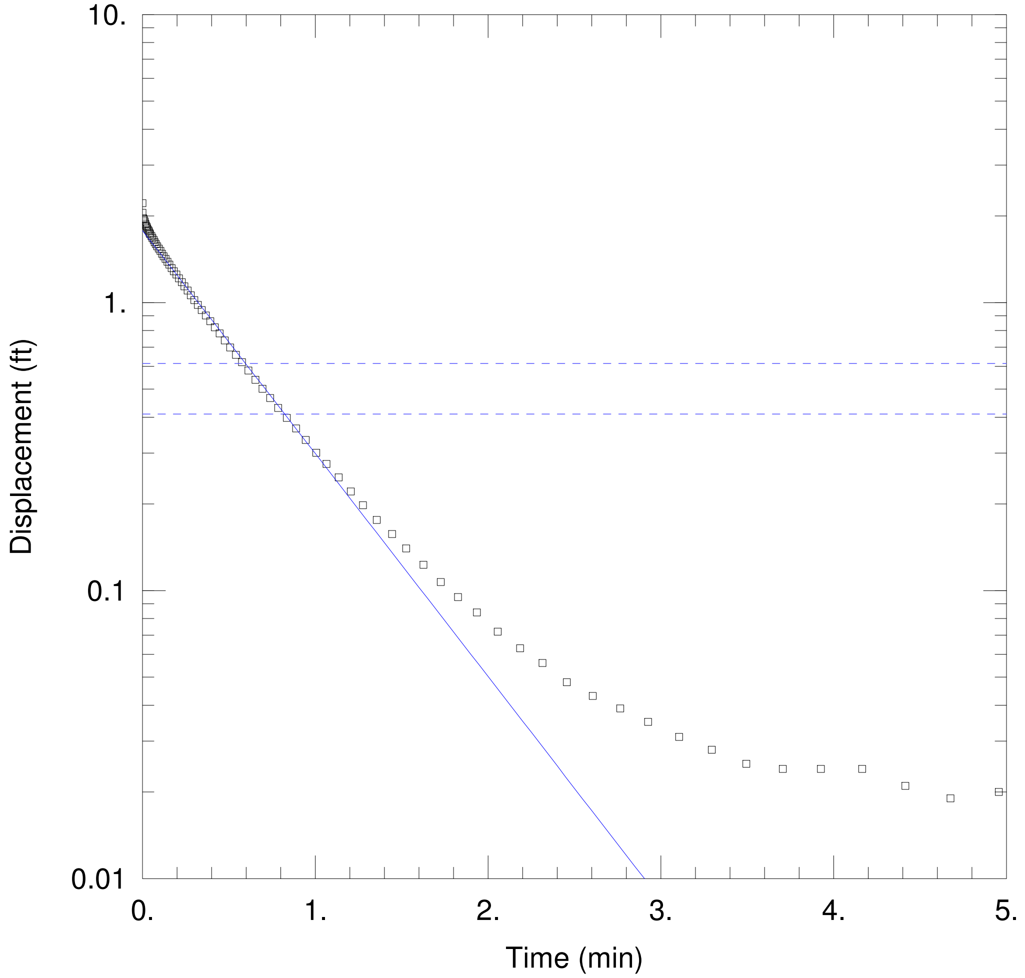
WELL DATA (PZ04 SLUG)

Initial Displacement: 2. ft
Total Well Penetration Depth: 10.88 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.88 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.738 ft/day
Kz/Kr = 0.1
Ss = 0.001667 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ06 BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 12:59:17

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ06 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft Anisotropy Ratio (Kz/Kr): 0.1

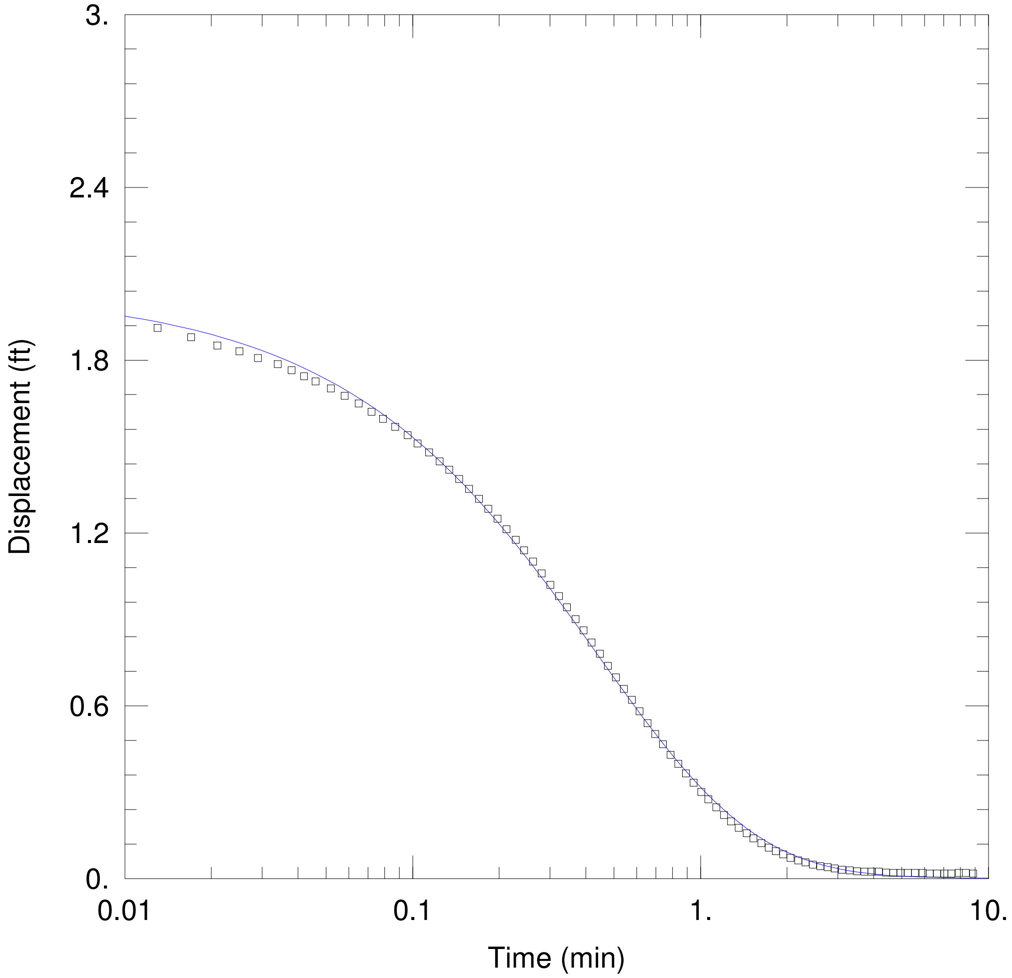
WELL DATA (PZ06 BAIL)

Initial Displacement: 2.05 ft
Total Well Penetration Depth: 11.46 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.46 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.946 ft/day y0 = 1.778 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ06 BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 12:59:35

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ06 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft

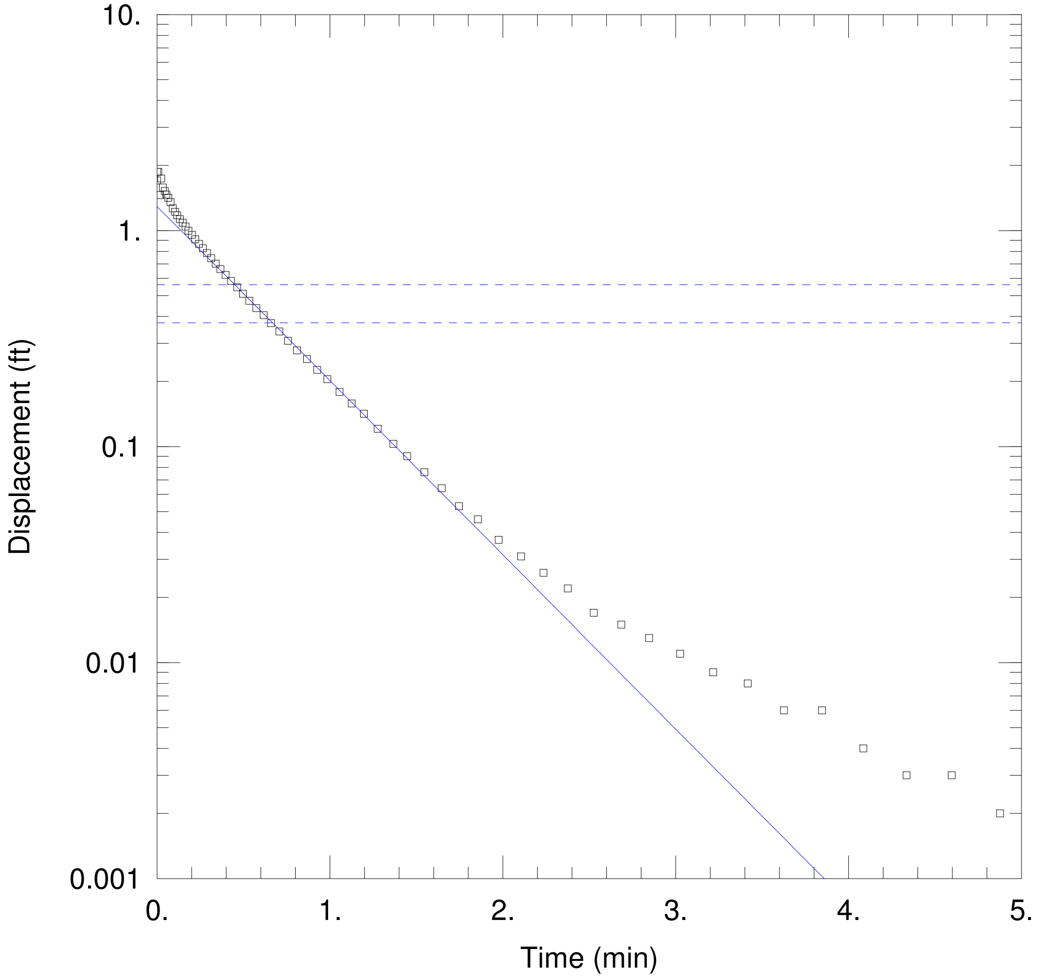
WELL DATA (PZ06 BAIL)

Initial Displacement: 2.05 ft
Total Well Penetration Depth: 11.46 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.46 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.709 ft/day
Kz/Kr = 0.1
Ss = 2.407E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ06 SLUG_SJS_BR_rev.aqt
Date: 07/10/19 Time: 12:59:52

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ06 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft Anisotropy Ratio (Kz/Kr): 1.

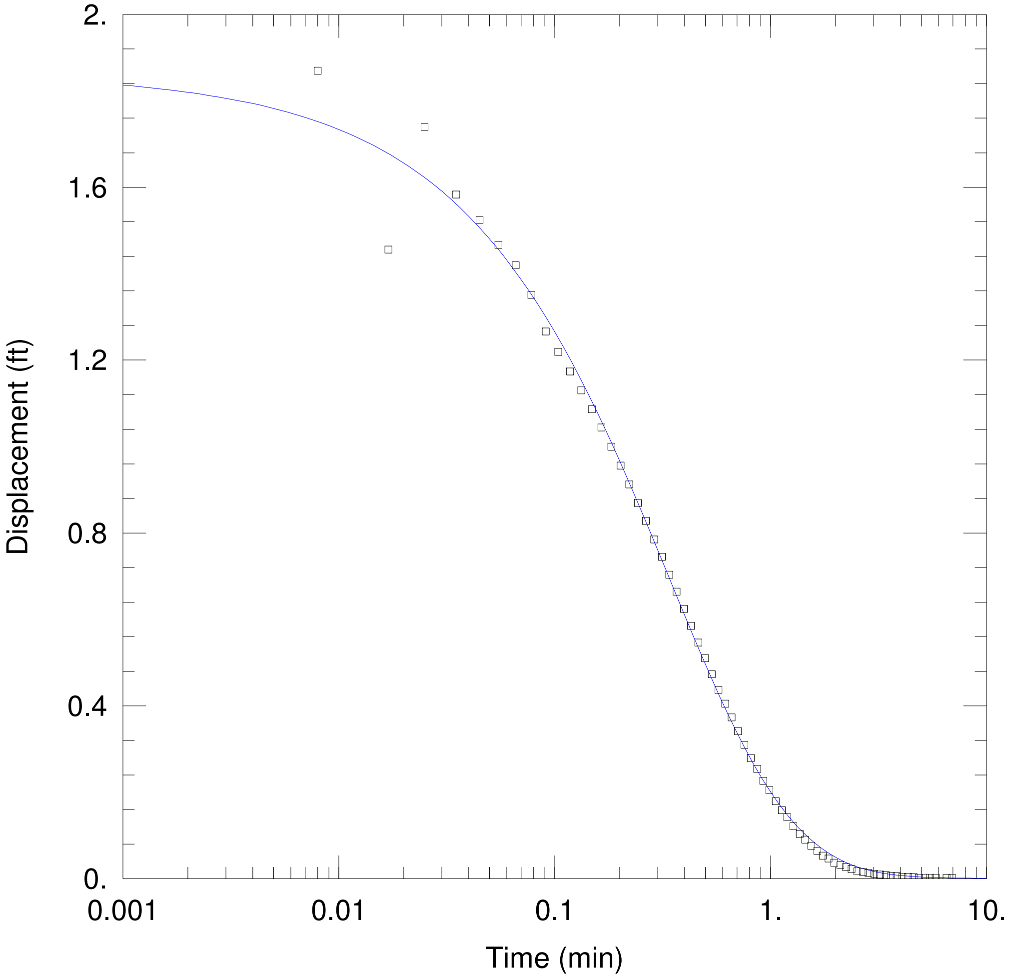
WELL DATA (PZ06 SLUG)

Initial Displacement: 1.87 ft Static Water Column Height: 11.46 ft
Total Well Penetration Depth: 11.46 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.215 ft/day y0 = 1.291 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ06 SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:00:07

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ06 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 60. ft

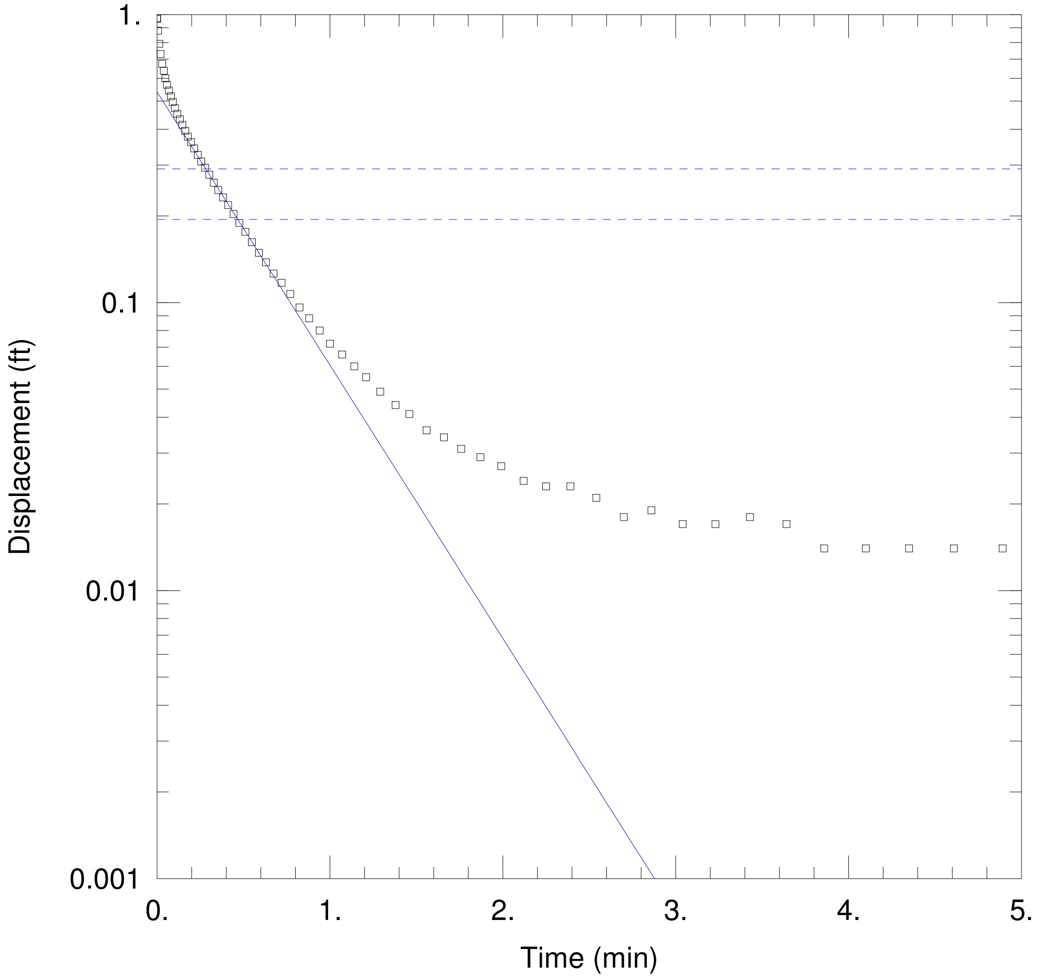
WELL DATA (PZ06 SLUG)

Initial Displacement: 1.87 ft
Total Well Penetration Depth: 11.46 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.46 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.511 ft/day
Kz/Kr = 1.
Ss = 0.0001258 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ10 BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:00:24

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ10 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 90. ft
Anisotropy Ratio (Kz/Kr): 0.1

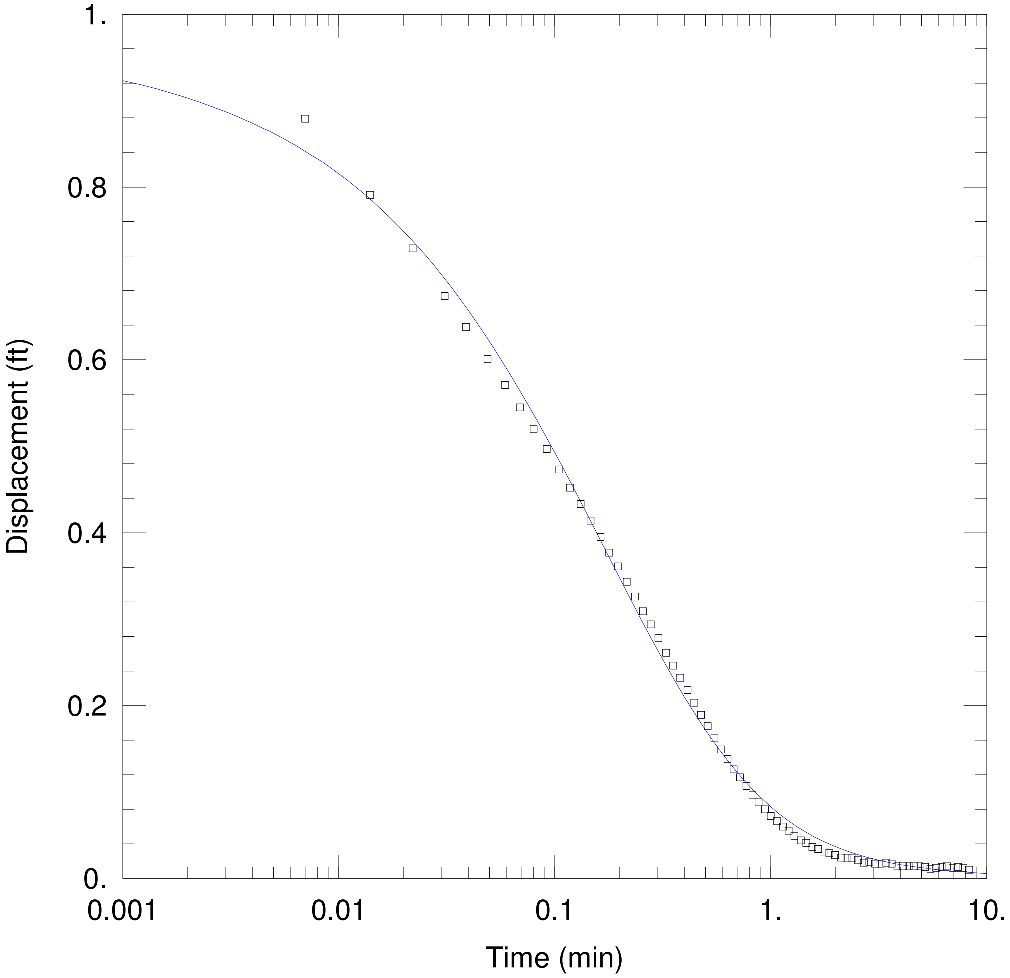
WELL DATA (PZ10 BAIL)

Initial Displacement: 0.97 ft
Static Water Column Height: 22.58 ft
Total Well Penetration Depth: 20.58 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.914 ft/day
y0 = 0.5383 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ10 BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:00:38

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ10 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 90. ft

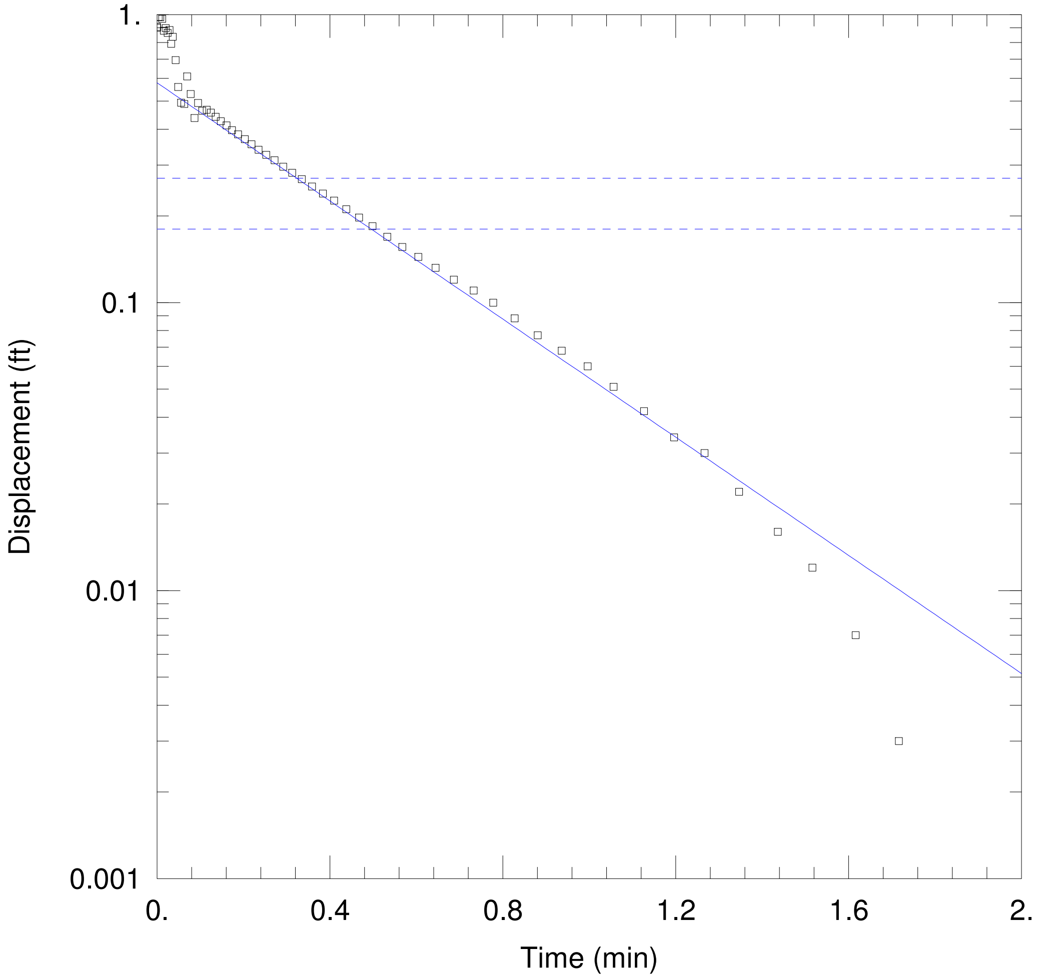
WELL DATA (PZ10 BAIL)

Initial Displacement: 0.97 ft
Total Well Penetration Depth: 20.58 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.58 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.914 ft/day
Kz/Kr = 0.1
Ss = 0.001111 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ10 SLUG_SJS_BR_rev.aqt
Date: 07/10/19
Time: 13:00:56

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ10 SLUG
Test Date: 10-10-18

AQUIFER DATA

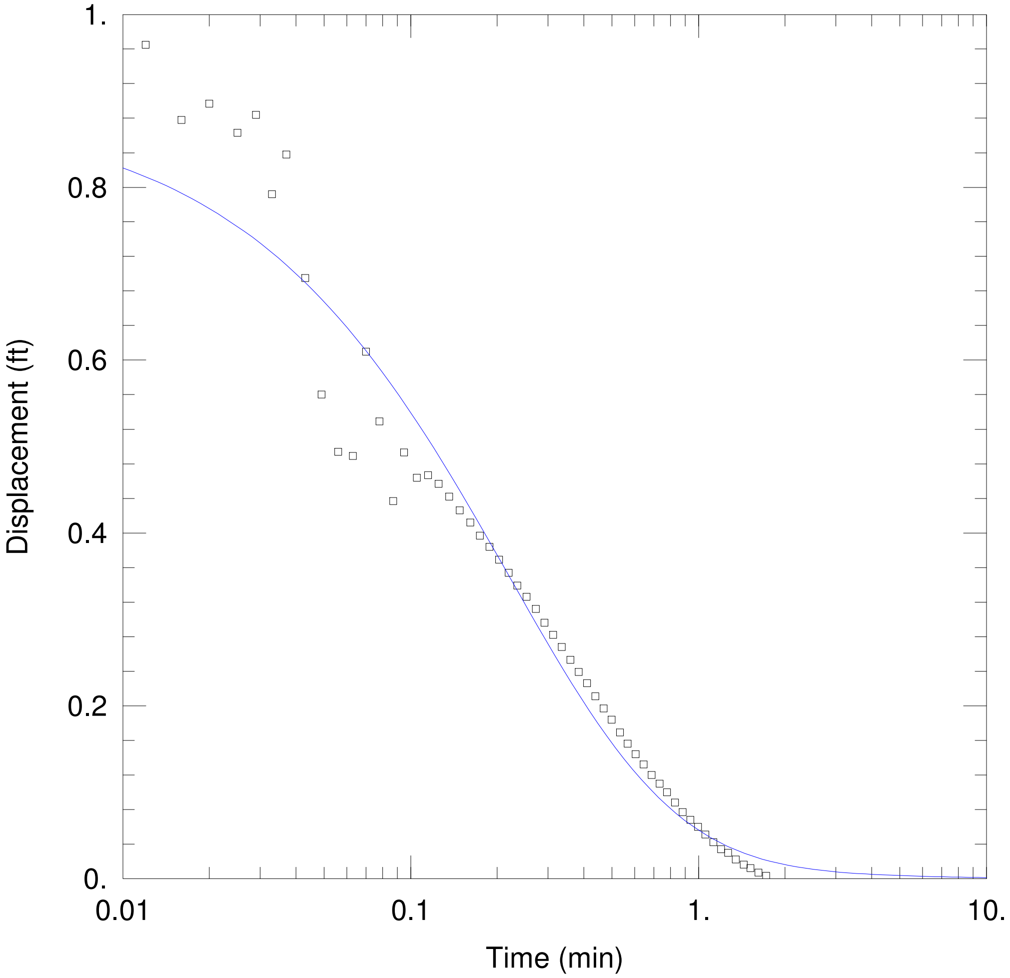
Saturated Thickness: 90. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ10 SLUG)

Initial Displacement: 0.9 ft
Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 20.26 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.222 ft/day
y0 = 0.5791 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ10 SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:01:13

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ10 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 90. ft

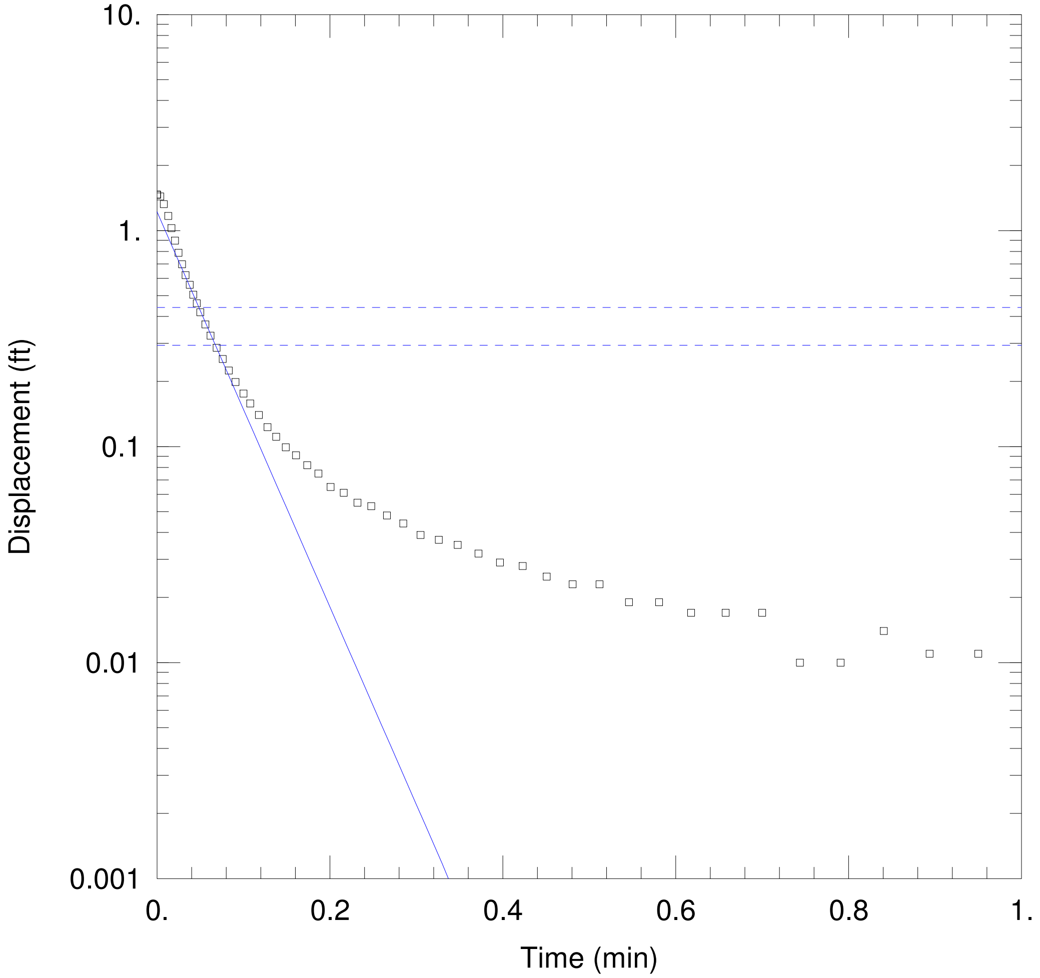
WELL DATA (PZ10 SLUG)

Initial Displacement: 0.9 ft
Total Well Penetration Depth: 20.26 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.6 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 6.39 ft/day
Kz/Kr = 0.1
Ss = 5.488E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ13 BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:01:29

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ13 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 62. ft
Anisotropy Ratio (Kz/Kr): 0.1

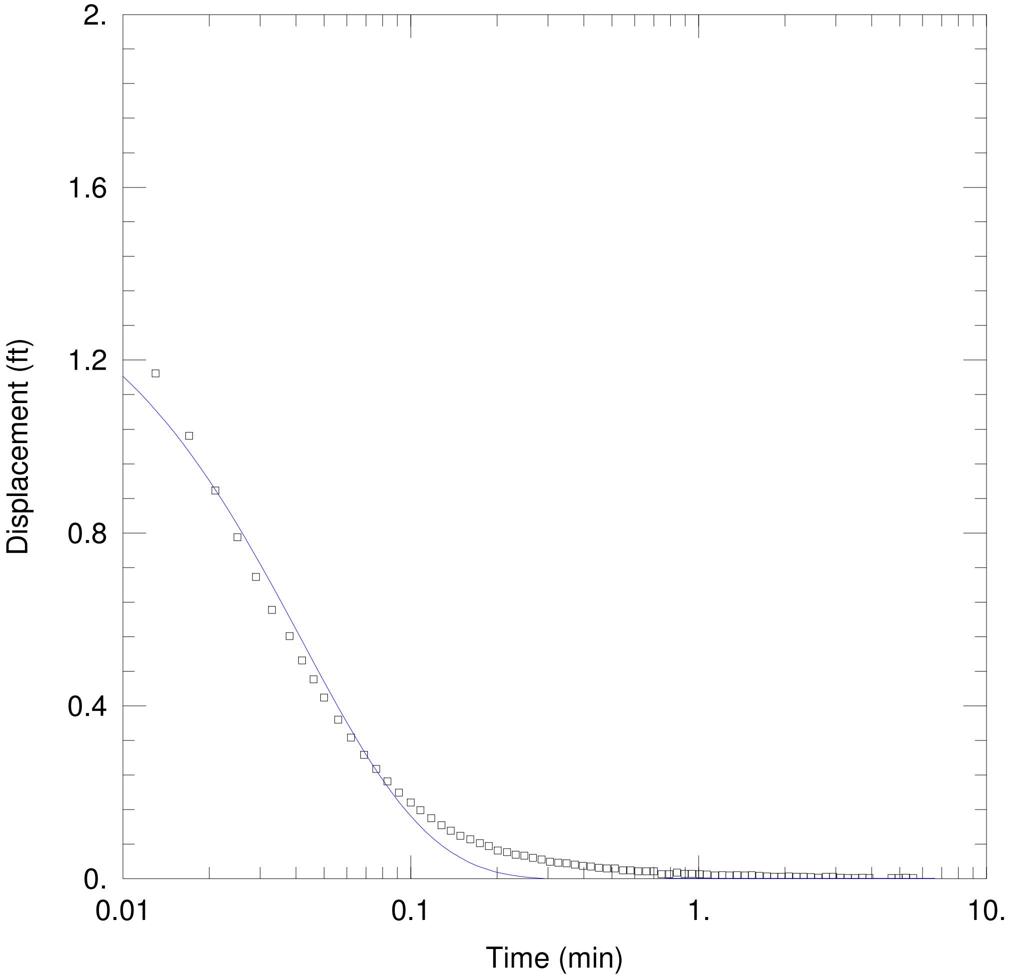
WELL DATA (PZ13 BAIL)

Initial Displacement: 1.47 ft
Static Water Column Height: 27.39 ft
Total Well Penetration Depth: 27.39 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 39.11 ft/day
y0 = 1.22 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ13 BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:01:45

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ13 BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 62. ft

WELL DATA (PZ13 BAIL)

Initial Displacement: 1.47 ft
Total Well Penetration Depth: 27.39 ft
Casing Radius: 0.083 ft

Static Water Column Height: 27.39 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

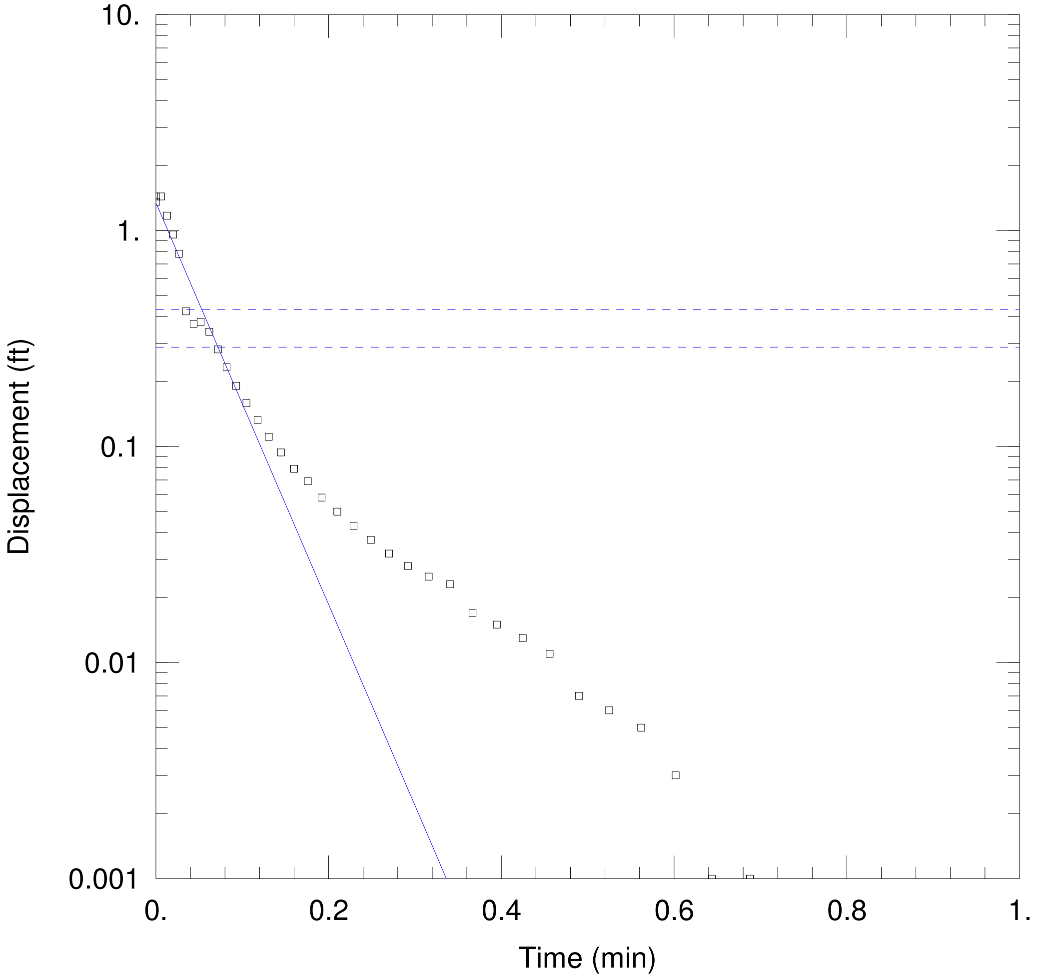
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 51.55 ft/day
Kz/Kr = 0.1

Ss = 1.613E-12 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ13 SLUG_SJS_BR_rev.aqt
Date: 07/10/19
Time: 13:02:02

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ13 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 62. ft
Anisotropy Ratio (Kz/Kr): 0.1

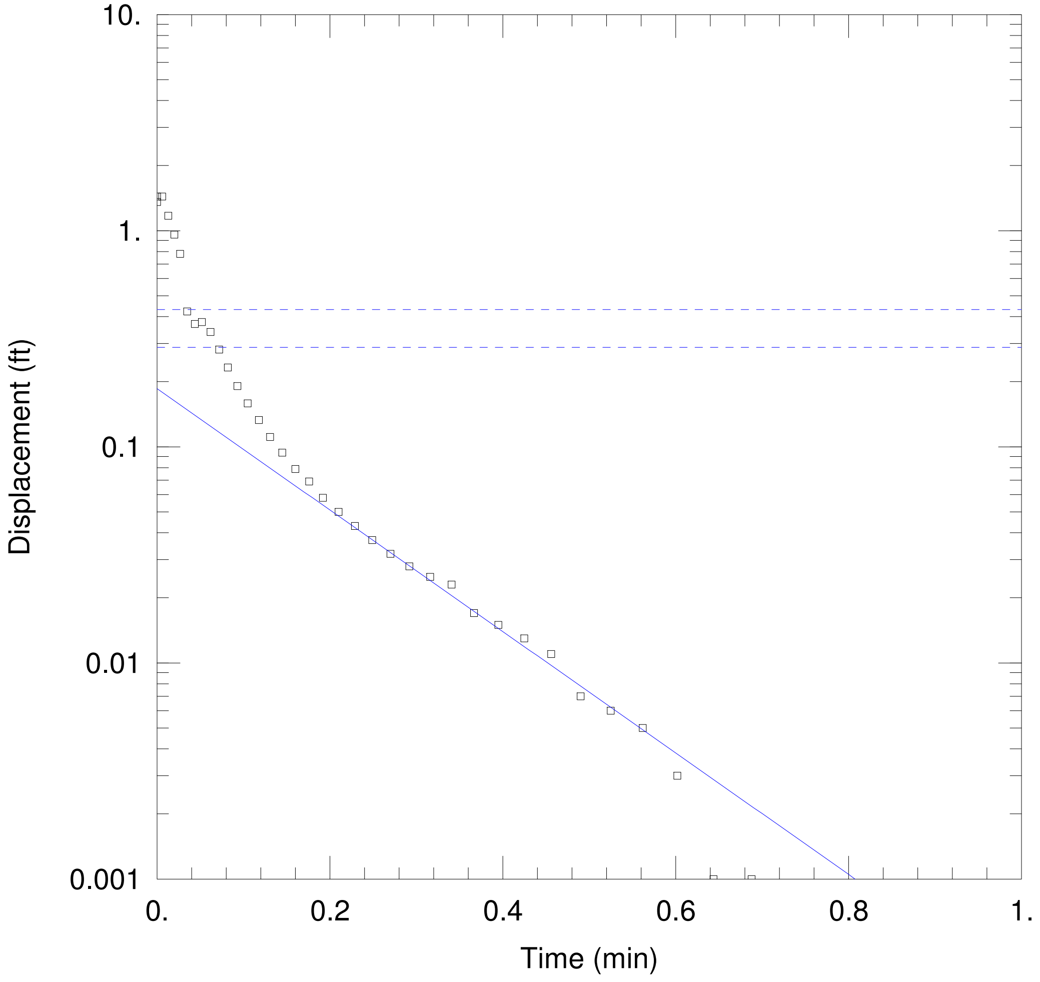
WELL DATA (PZ13 SLUG)

Initial Displacement: 1.44 ft
Static Water Column Height: 27.4 ft
Total Well Penetration Depth: 27.4 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 39.77 ft/day
y0 = 1.345 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ13 SLUG_SJS_BRlt_rev.aqt
Date: 07/10/19
Time: 13:02:22

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ13 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 62. ft
Anisotropy Ratio (Kz/Kr): 0.1

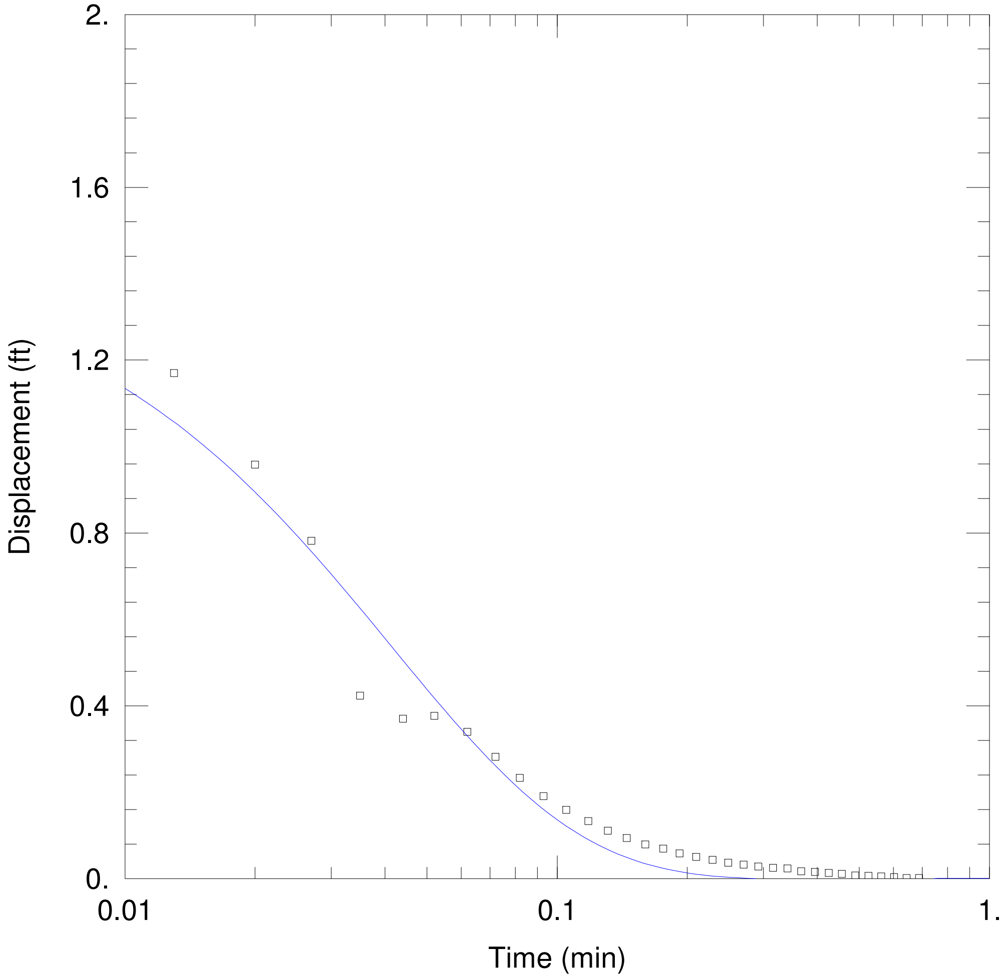
WELL DATA (PZ13 SLUG)

Initial Displacement: 1.44 ft
Static Water Column Height: 27.4 ft
Total Well Penetration Depth: 27.4 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 12.01 ft/day
y0 = 0.1856 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ13 SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:02:39

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ13 SLUG
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 62. ft

WELL DATA (PZ13 SLUG)

Initial Displacement: 1.44 ft
Total Well Penetration Depth: 27.4 ft
Casing Radius: 0.083 ft

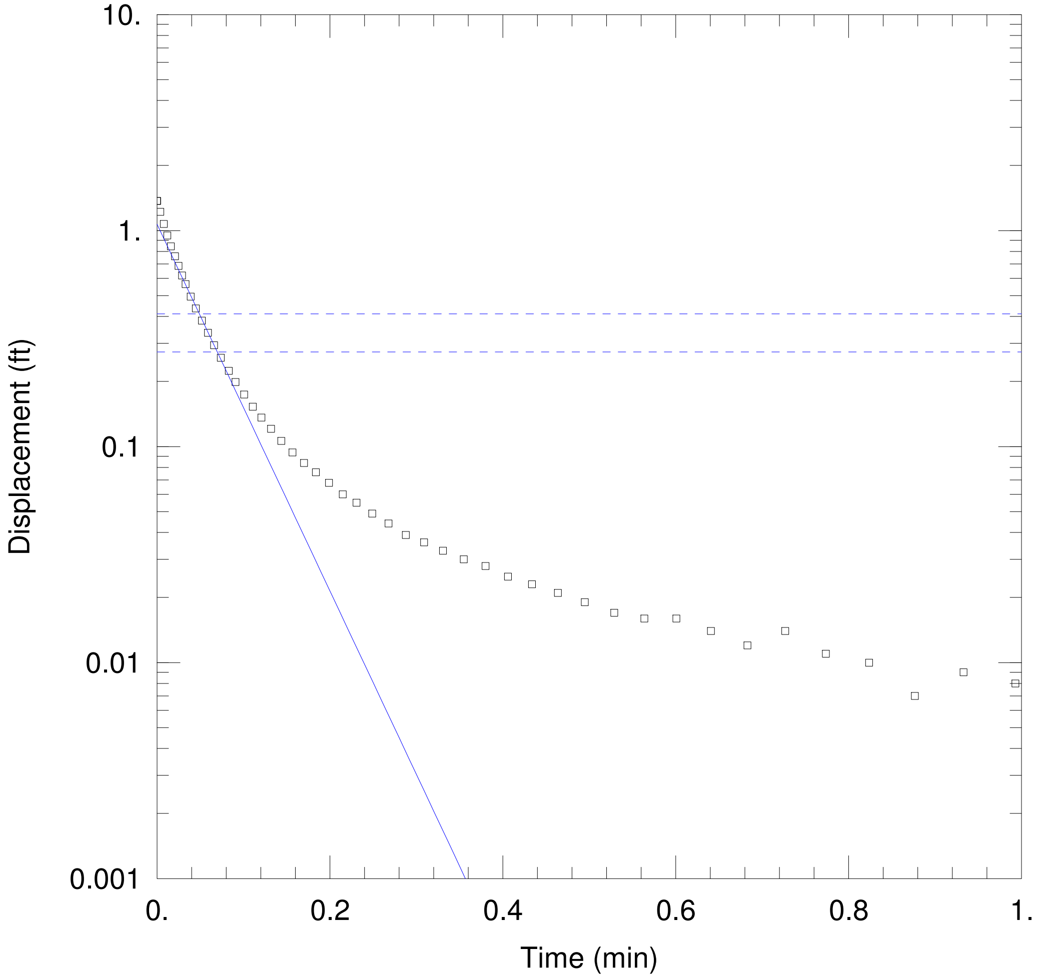
Static Water Column Height: 27.4 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 52.42 ft/day
Kz/Kr = 0.1

Ss = 1.613E-12 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ16S BAIL_SJS_BR_rev.aqt

Date: 07/10/19 Time: 13:02:57

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16S BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

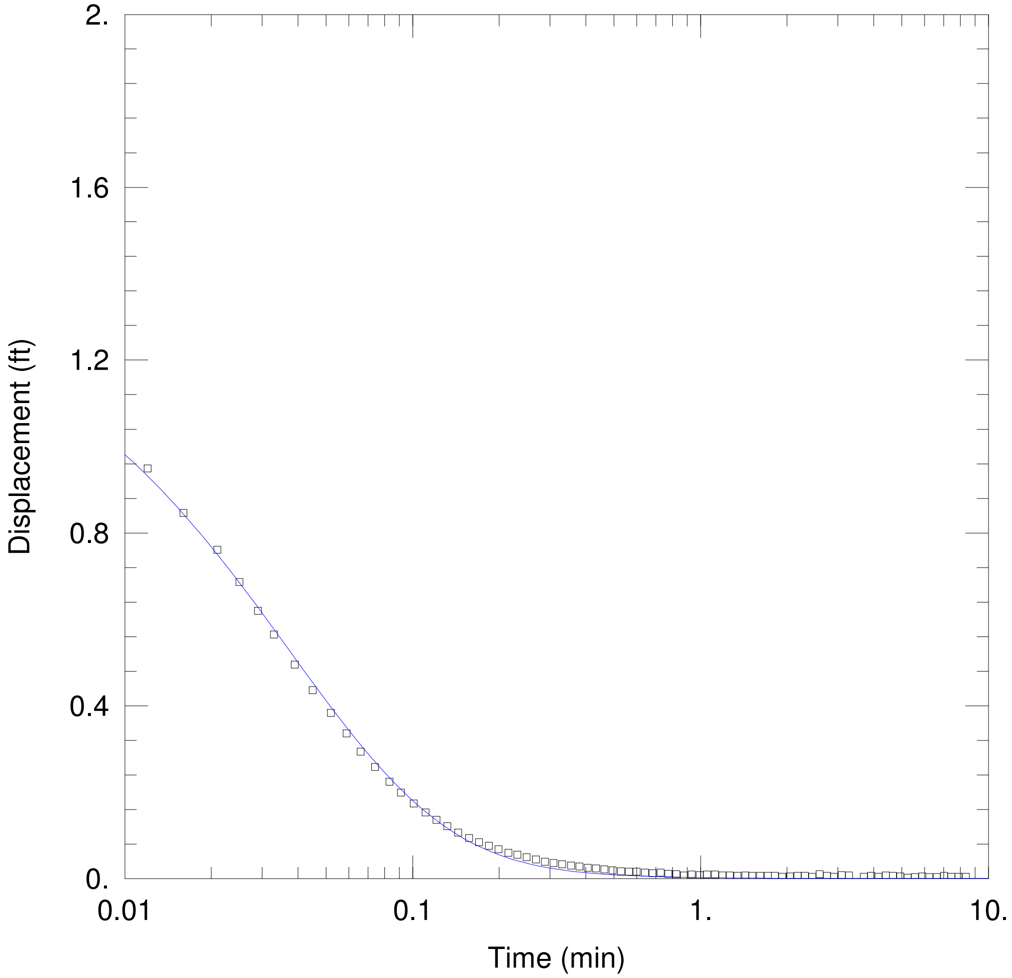
WELL DATA (PZ16S BAIL)

Initial Displacement: 1.37 ft
Static Water Column Height: 16.91 ft
Total Well Penetration Depth: 16.91 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 34.13 ft/day
y0 = 1.069 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ16S BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:03:48

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16S BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 100. ft

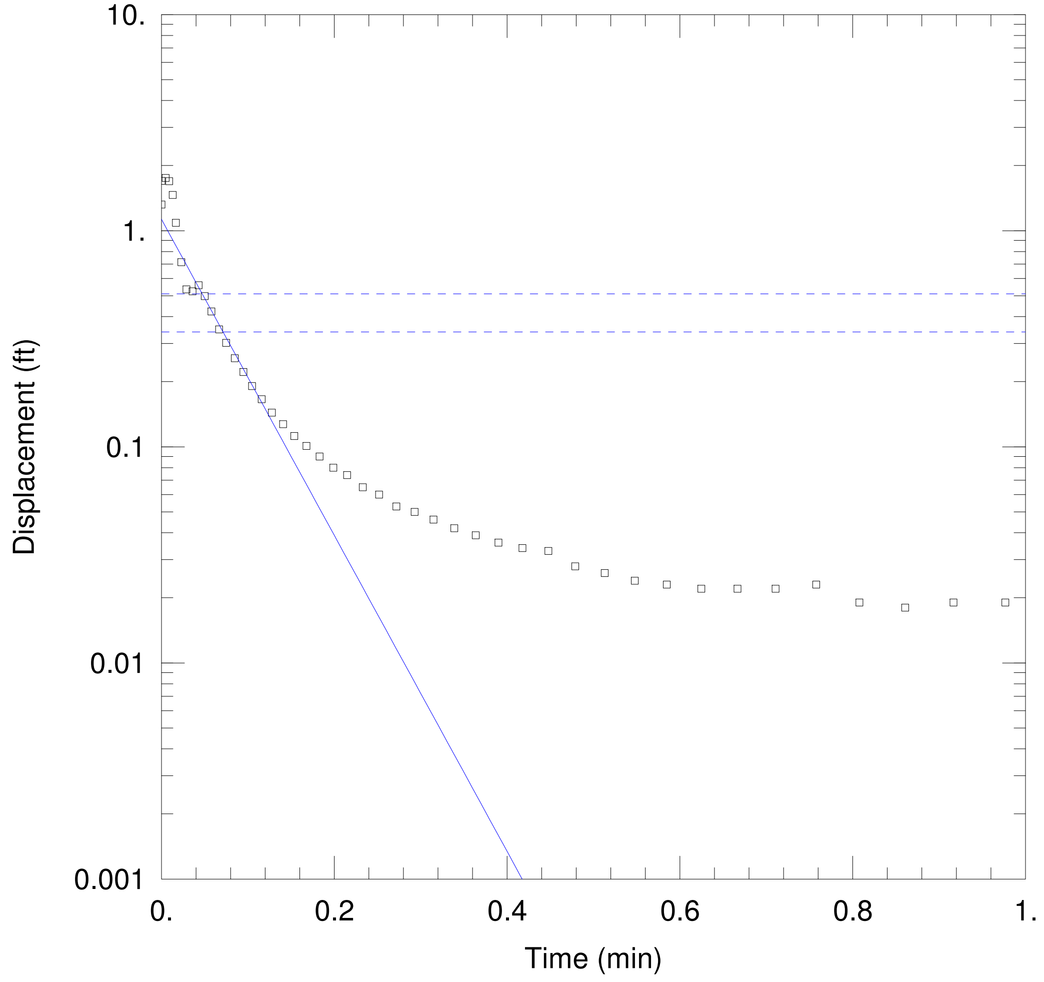
WELL DATA (PZ16S BAIL)

Initial Displacement: 1.37 ft
Total Well Penetration Depth: 16.91 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.91 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 41.03 ft/day
Kz/Kr = 0.1
Ss = 3.337E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ16S SLUG_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:04:12

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16S SLUG
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

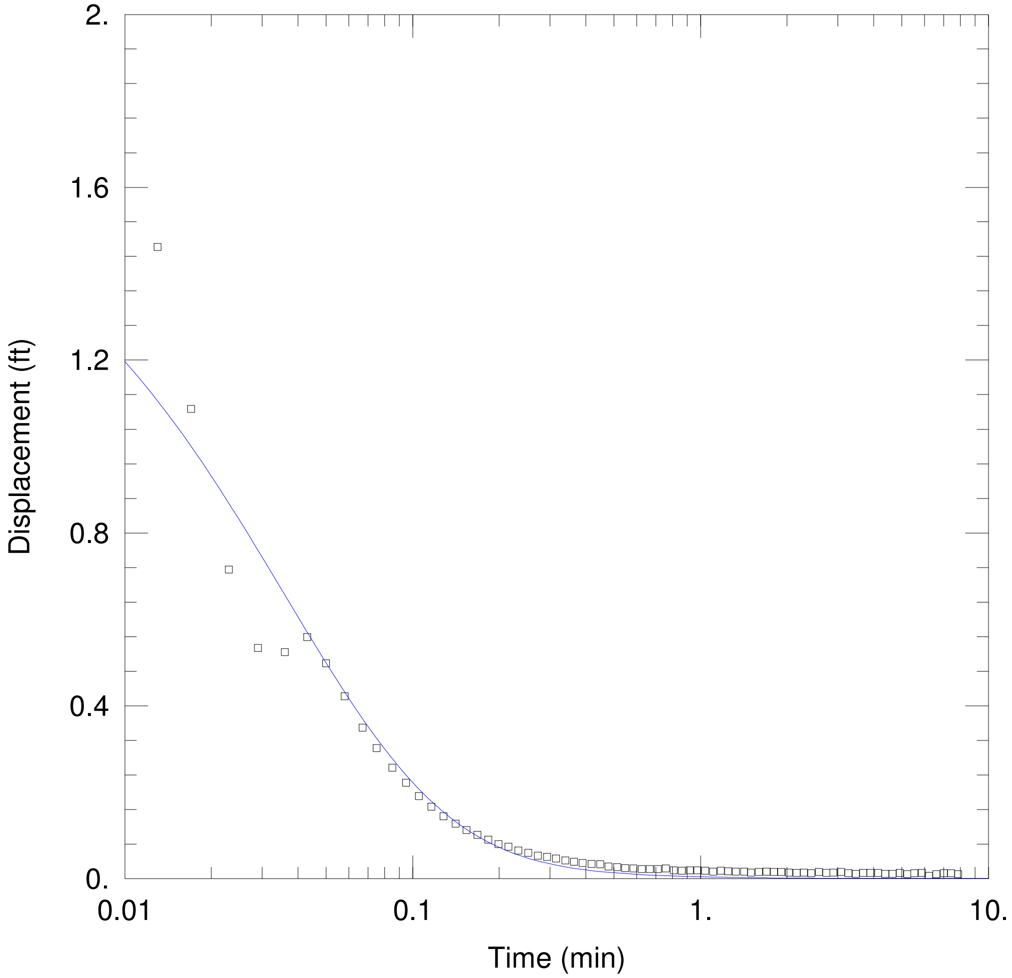
WELL DATA (PZ16S SLUG)

Initial Displacement: 1.7 ft
Static Water Column Height: 16.9 ft
Total Well Penetration Depth: 16.9 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 29.39 ft/day
y0 = 1.127 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ16S SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:04:29

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16S SLUG
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 100. ft

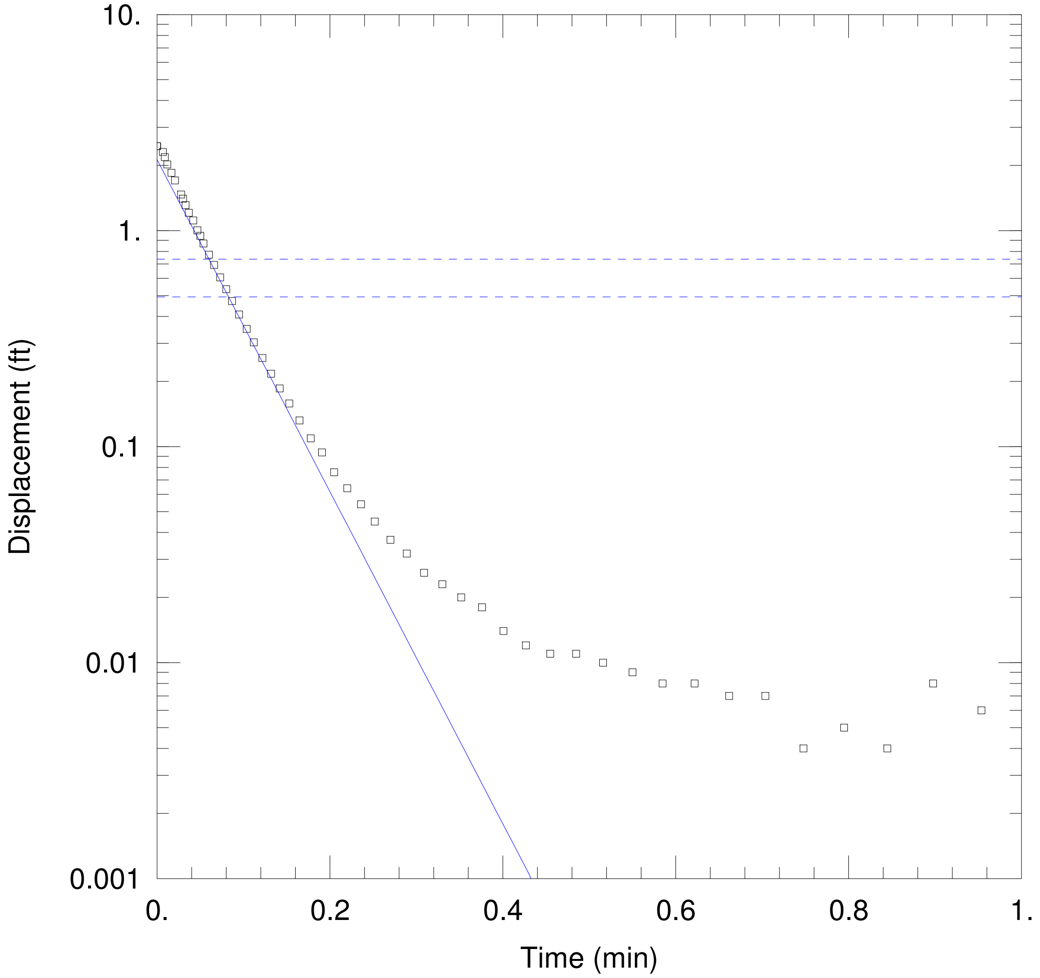
WELL DATA (PZ16S SLUG)

Initial Displacement: 1.7 ft
Total Well Penetration Depth: 16.9 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.9 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 39.9 ft/day
Kz/Kr = 0.1
Ss = 5.088E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ17D BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:04:48

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ17D BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 110. ft
Anisotropy Ratio (Kz/Kr): 0.1

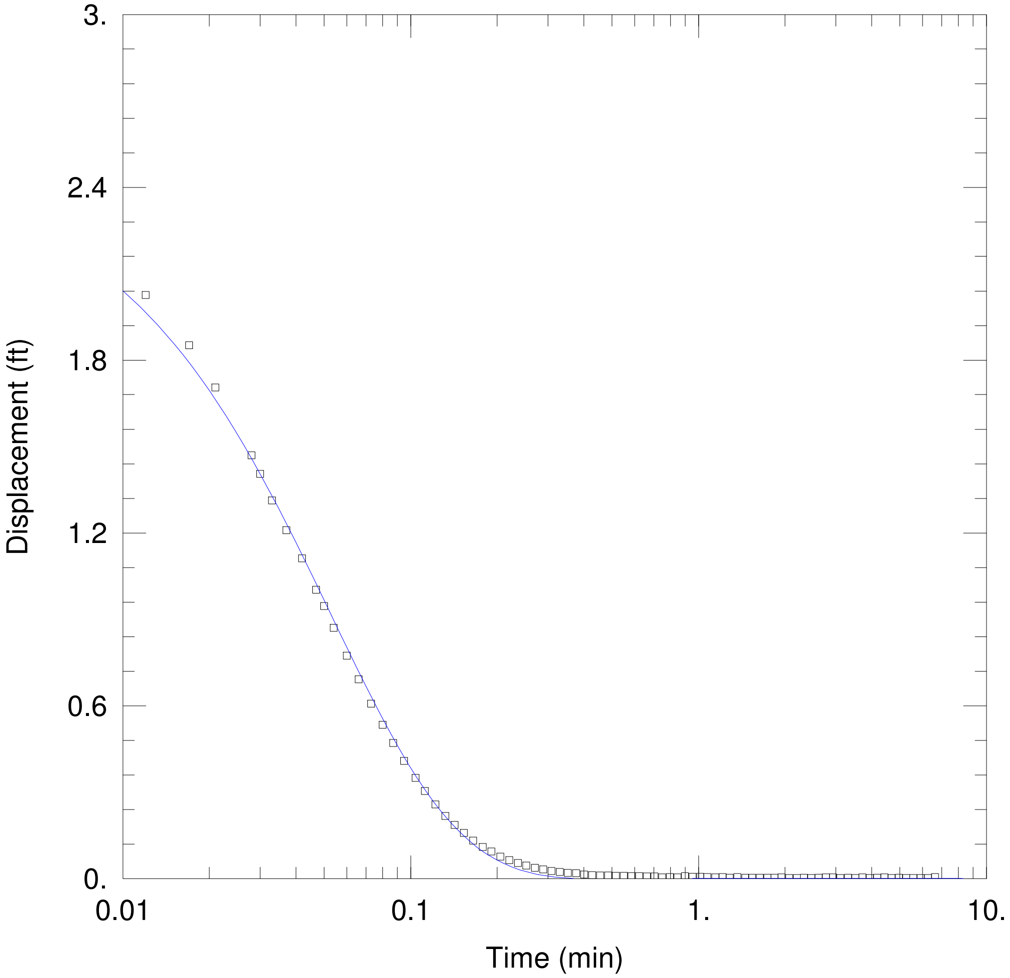
WELL DATA (PZ17D BAIL)

Initial Displacement: 2.46 ft
Static Water Column Height: 41.07 ft
Total Well Penetration Depth: 41.07 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 34.43 ft/day
y0 = 2.13 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ17D BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:05:26

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ17D BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 110. ft

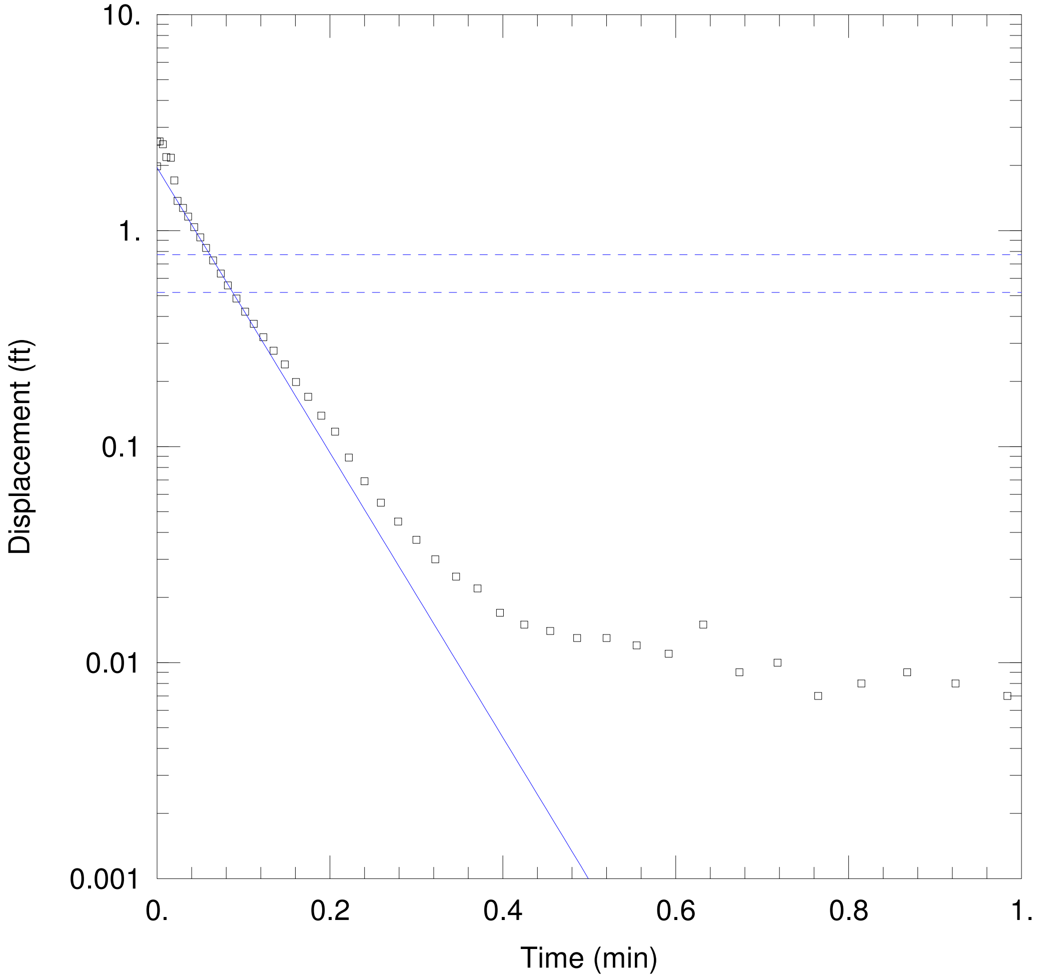
WELL DATA (PZ17D BAIL)

Initial Displacement: 2.46 ft
Static Water Column Height: 41.07 ft
Total Well Penetration Depth: 41.07 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 41.4 ft/day
Ss = 8.547E-13 ft^{-1}
Kz/Kr = 0.1



WELL TEST ANALYSIS

Data Set: H:\...\PZ17D SLUG_SJS_BR_rev.aqt
Date: 07/10/19
Time: 13:05:43

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ17D SLUG
Test Date: 10-11-18

AQUIFER DATA

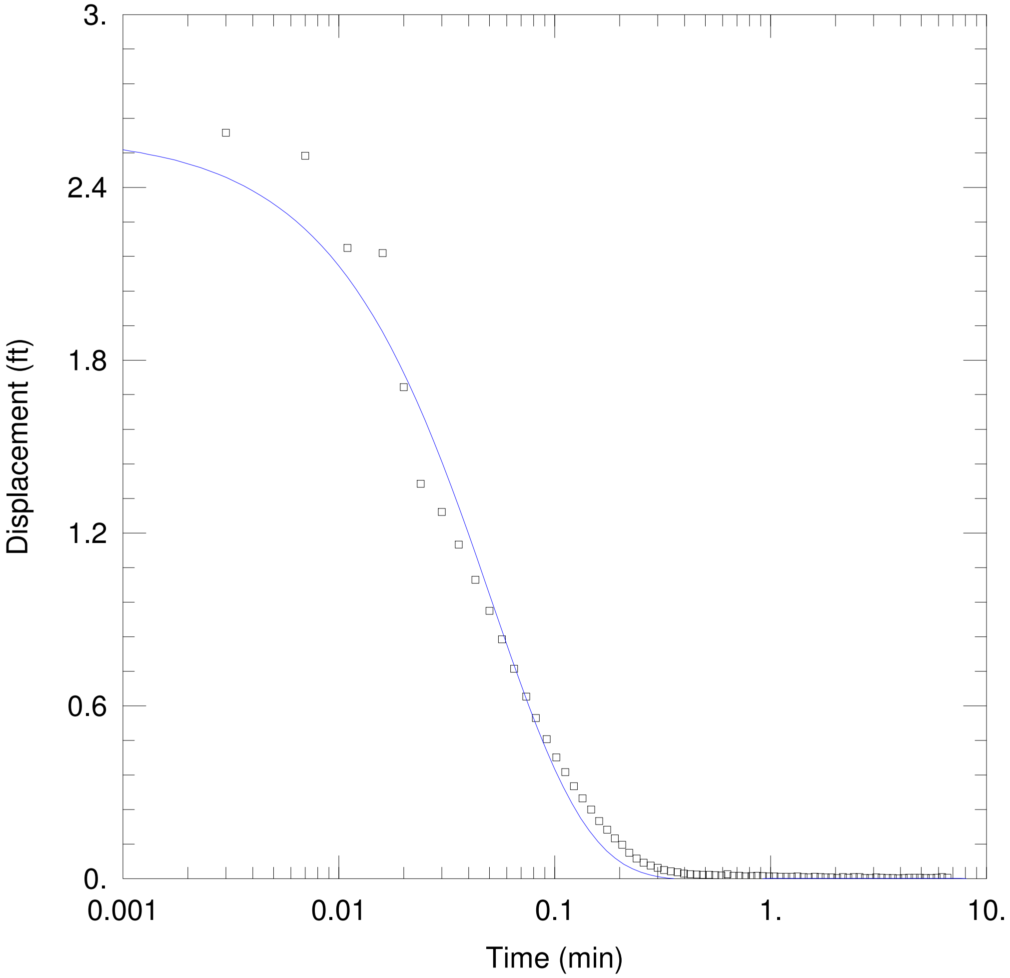
Saturated Thickness: 110. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ17D SLUG)

Initial Displacement: 2.58 ft
Static Water Column Height: 41.06 ft
Total Well Penetration Depth: 41.06 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 29.53 ft/day
y0 = 1.952 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ17D SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:06:00

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ17D SLUG
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 110. ft

WELL DATA (PZ17D SLUG)

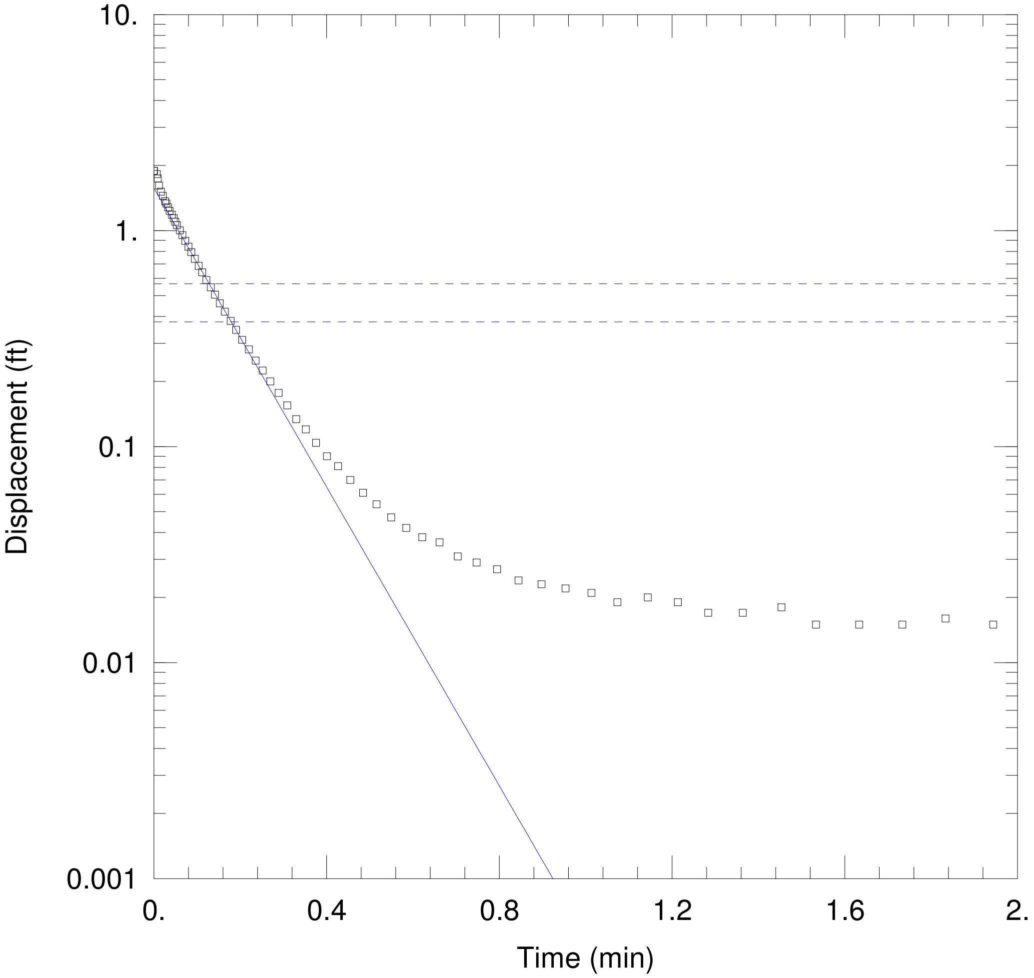
Initial Displacement: 2.58 ft
Total Well Penetration Depth: 41.06 ft
Casing Radius: 0.083 ft

Static Water Column Height: 41.06 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 42.69 ft/day
Kz/Kr = 0.1
Ss = 8.547E-13 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ20D BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:06:17

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ20D BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 120. ft
Anisotropy Ratio (Kz/Kr): 0.1

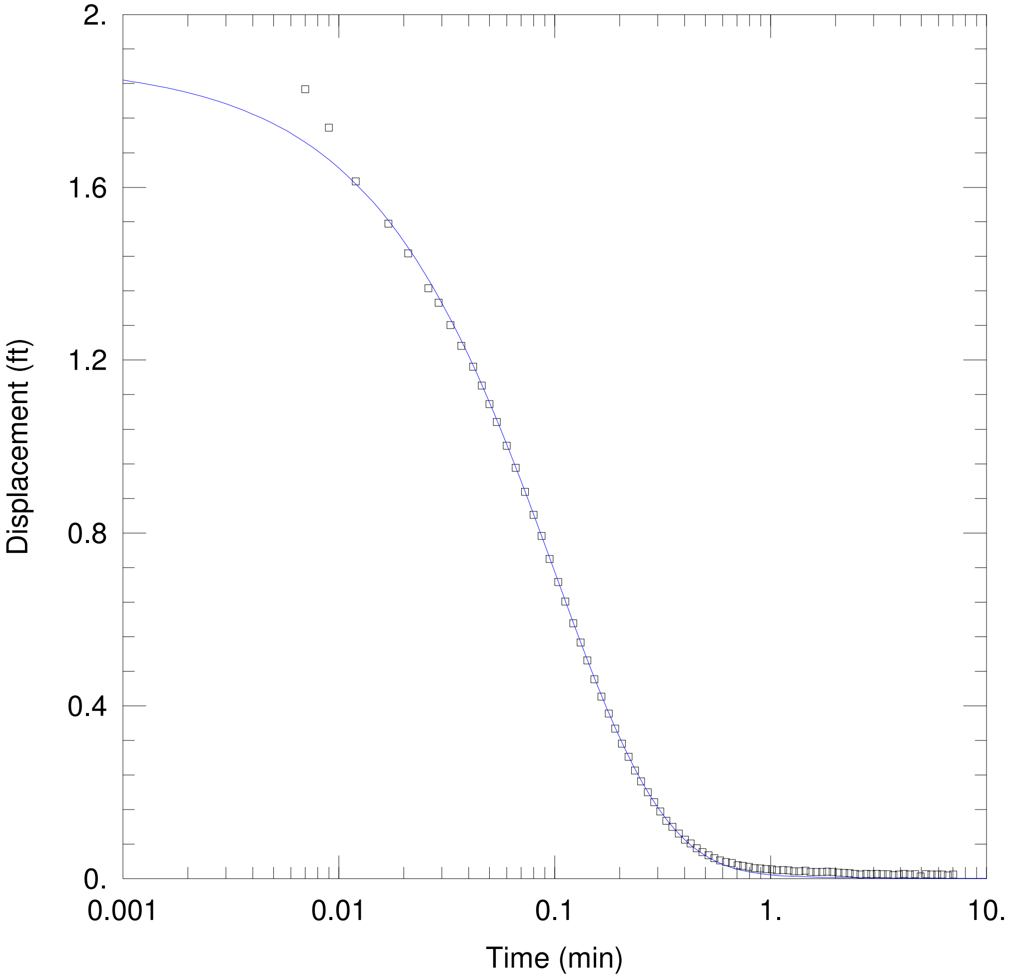
WELL DATA (PZ20D BAIL)

Initial Displacement: 1.89 ft
Static Water Column Height: 36.78 ft
Total Well Penetration Depth: 36.78 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 15.3 ft/day
y0 = 1.571 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ20D BAIL_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:06:37

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ20D BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 120. ft

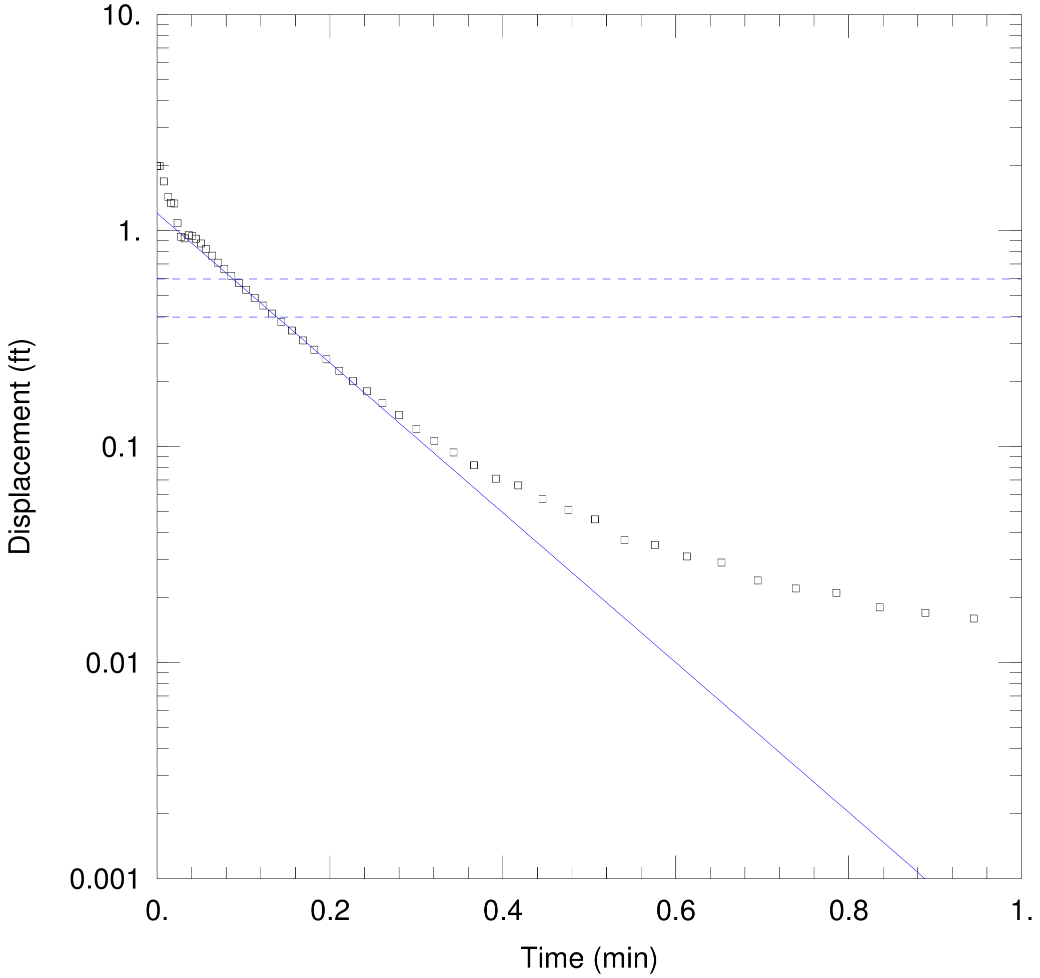
WELL DATA (PZ20D BAIL)

Initial Displacement: 1.89 ft
Total Well Penetration Depth: 36.78 ft
Casing Radius: 0.083 ft
Static Water Column Height: 36.78 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 18.41 ft/day
Kz/Kr = 0.1
Ss = 8.183E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ20D SLUG_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:06:54

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ20D SLUG
Test Date: 10-11-18

AQUIFER DATA

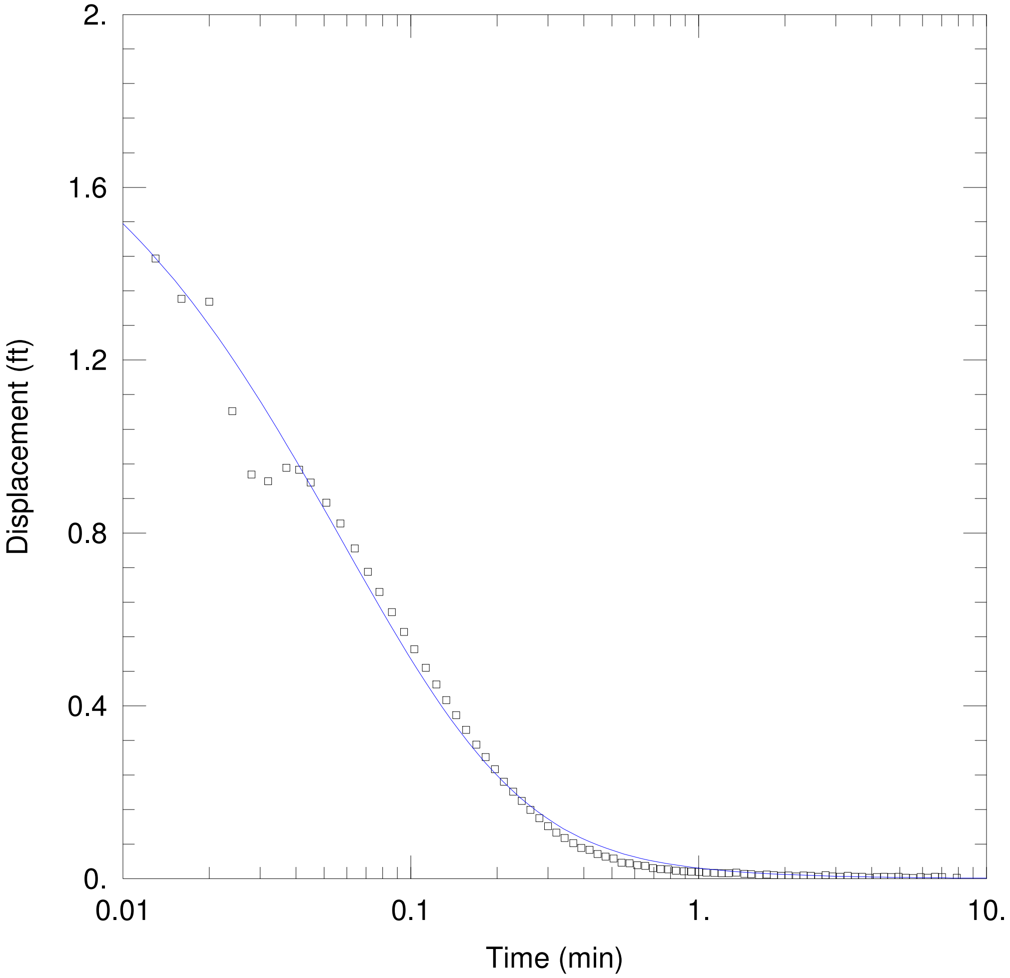
Saturated Thickness: 120. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ20D SLUG)

Initial Displacement: 1.99 ft
Static Water Column Height: 36.78 ft
Total Well Penetration Depth: 36.78 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 15.34 ft/day
y0 = 1.203 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ20D SLUG_SJS_KGS_rev.aqt
Date: 07/10/19 Time: 13:07:11

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ20D SLUG
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 120. ft

WELL DATA (PZ20D SLUG)

Initial Displacement: 1.99 ft
Total Well Penetration Depth: 36.78 ft
Casing Radius: 0.083 ft

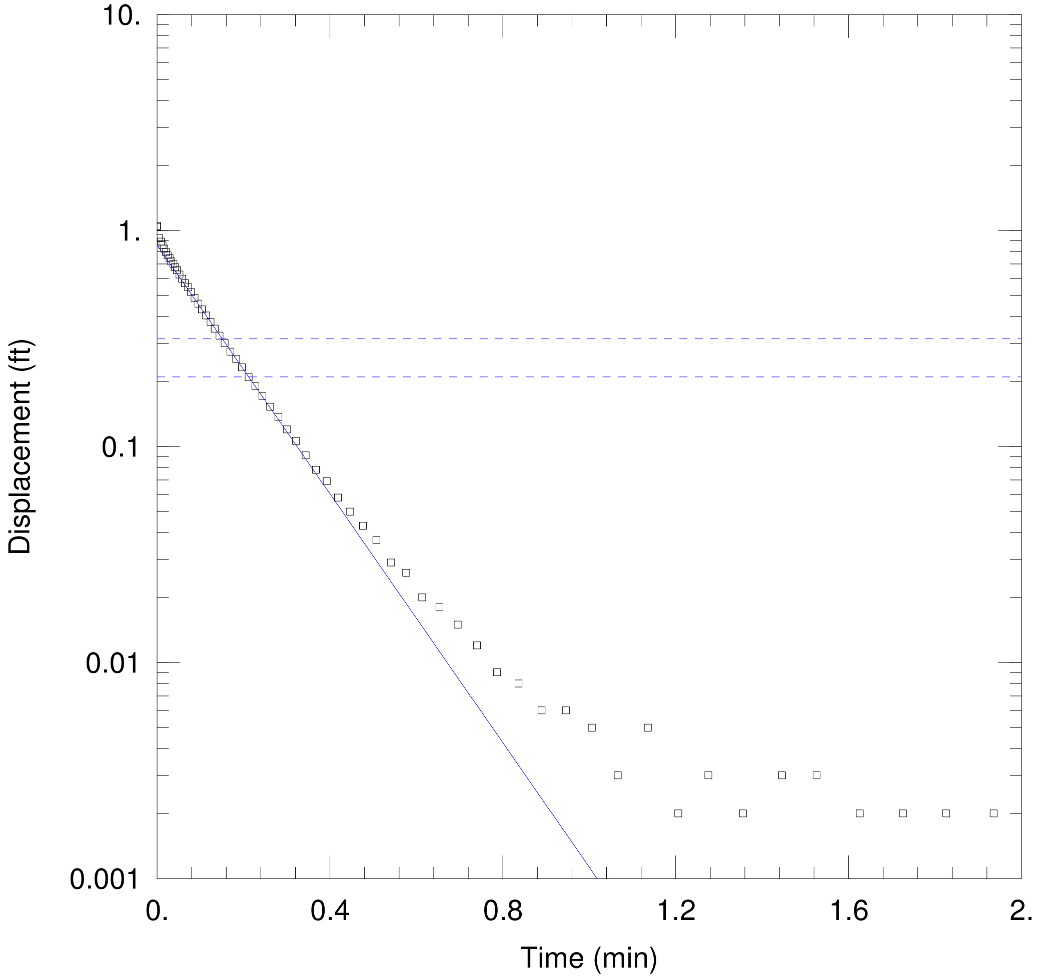
Static Water Column Height: 36.78 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 18.44 ft/day
Kz/Kr = 0.1

Ss = 0.0002171 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ24 BAIL_SJS_BR_rev.aqt
Date: 07/11/19 Time: 11:17:33

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ24 BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 107. ft
Anisotropy Ratio (Kz/Kr): 0.1

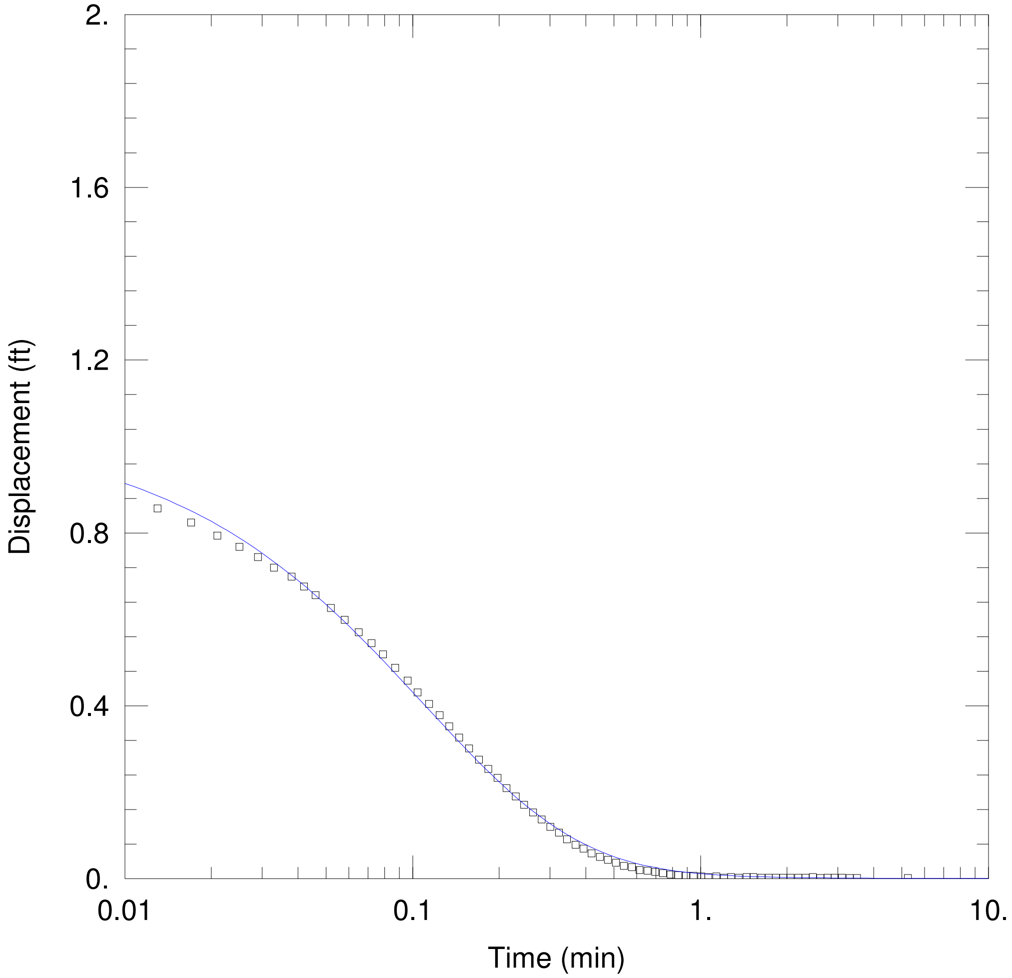
WELL DATA (PZ24 BAIL)

Initial Displacement: 1.05 ft
Static Water Column Height: 19.08 ft
Total Well Penetration Depth: 19.08 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 11.77 ft/day
y0 = 0.8568 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ24 BAIL_SJS_KGS_rev.aqt
Date: 07/11/19 Time: 11:18:08

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ24 BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 107. ft

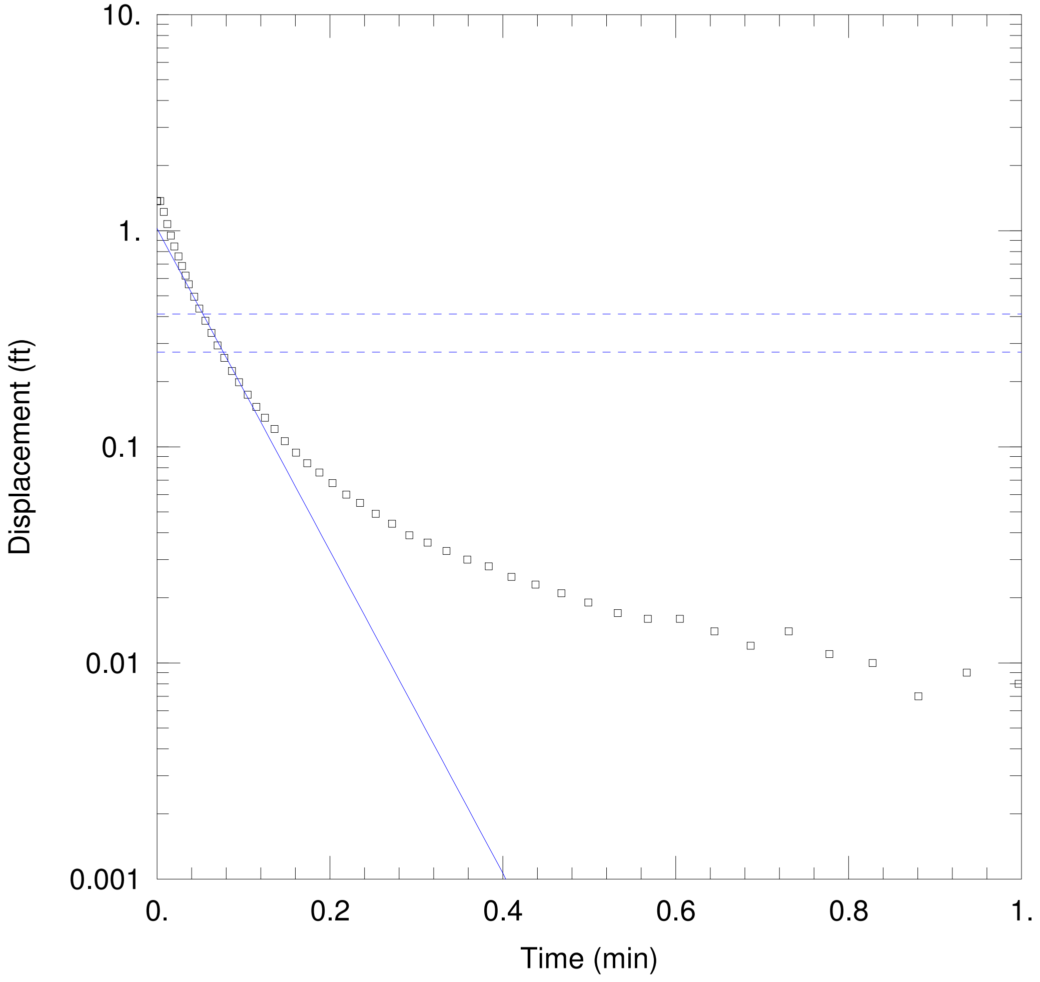
WELL DATA (PZ24 BAIL)

Initial Displacement: 1.05 ft
Total Well Penetration Depth: 19.08 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.08 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 14.81 ft/day
Kz/Kr = 0.1
Ss = 2.185E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: H:\...\PZ24 SLUG_SJS_BR_rev.aqt
Date: 07/11/19 Time: 11:18:33

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16 BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 107. ft
Anisotropy Ratio (Kz/Kr): 0.1

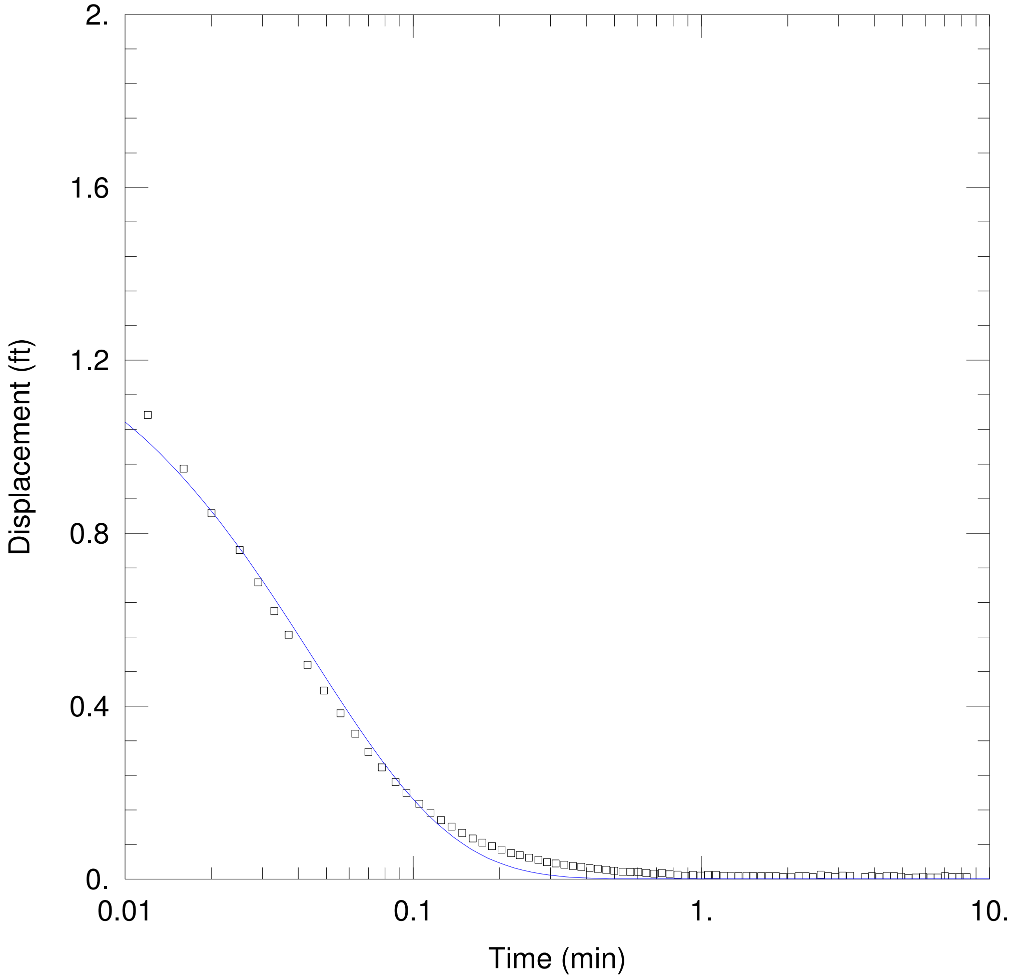
WELL DATA (PZ24 SLUG)

Initial Displacement: 1.37 ft
Static Water Column Height: 19.08 ft
Total Well Penetration Depth: 19.08 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 30.46 ft/day
y0 = 1.021 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ24 SLUG_SJS_KGS_rev.aqt
Date: 07/11/19 Time: 11:19:06

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ16 BAIL
Test Date: 10-11-18

AQUIFER DATA

Saturated Thickness: 107. ft

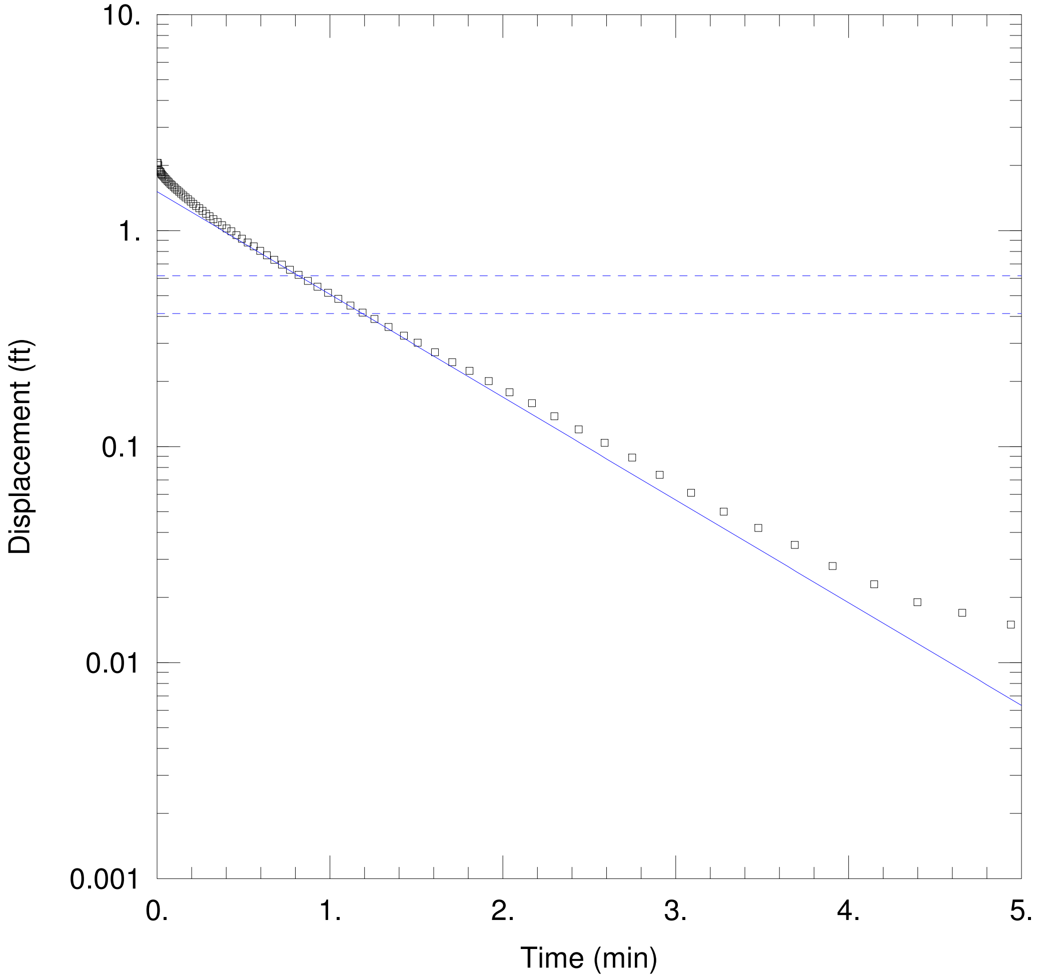
WELL DATA (PZ24 SLUG)

Initial Displacement: 1.37 ft
Static Water Column Height: 19.08 ft
Total Well Penetration Depth: 19.08 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 44.03 ft/day
Ss = 3.191E-6 ft^{-1}
Kz/Kr = 0.1



WELL TEST ANALYSIS

Data Set: H:\...\PZ28D BAIL_SJS_BR_rev.aqt
Date: 07/10/19 Time: 13:07:26

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ28D BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 121. ft
Anisotropy Ratio (Kz/Kr): 0.1

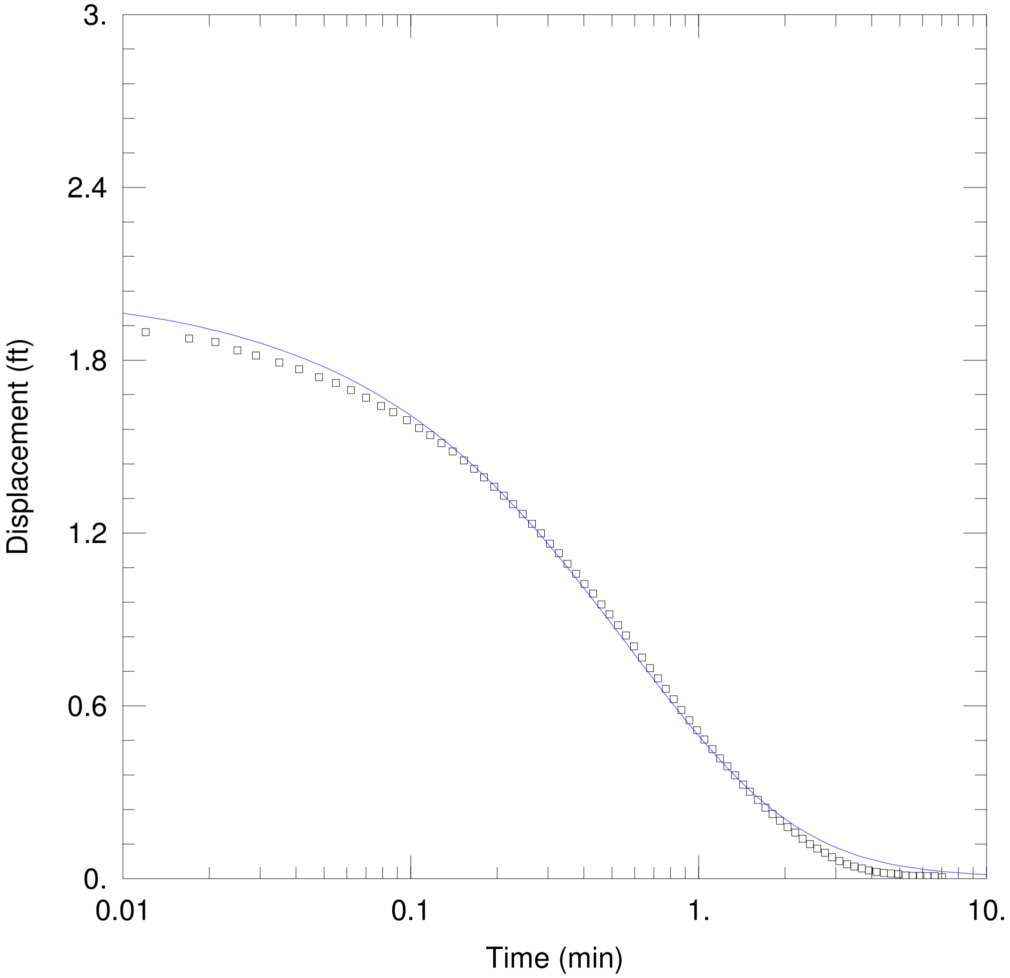
WELL DATA (PZ28 BAIL)

Initial Displacement: 2.06 ft
Static Water Column Height: 28.03 ft
Total Well Penetration Depth: 28.03 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.038 ft/day
y0 = 1.513 ft



WELL TEST ANALYSIS

Data Set: H:\...\PZ28D BAIL_SJS_KGS_rev.aqt
Date: 07/10/19
Time: 13:07:41

PROJECT INFORMATION

Company: TTL, INC.
Client: TWIN PINES
Test Well: PZ28D BAIL
Test Date: 10-10-18

AQUIFER DATA

Saturated Thickness: 121. ft

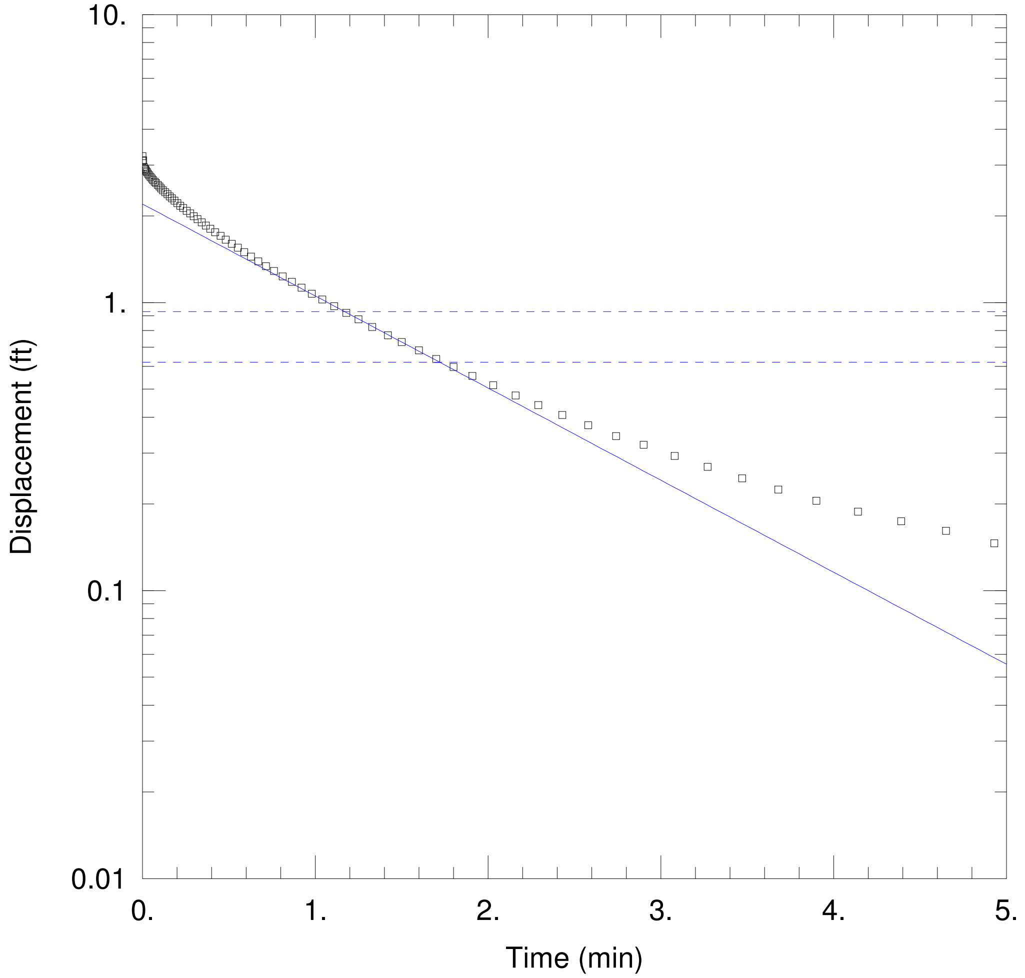
WELL DATA (PZ28 BAIL)

Initial Displacement: 2.06 ft
Static Water Column Height: 28.03 ft
Total Well Penetration Depth: 28.03 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.34 ft/day
Ss = 6.988E-5 ft^{-1}
Kz/Kr = 0.1



TWIN PINES - PZ29D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ29D Bail_BR_SJS.aqt
Date: 06/03/19
Time: 14:22:17

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

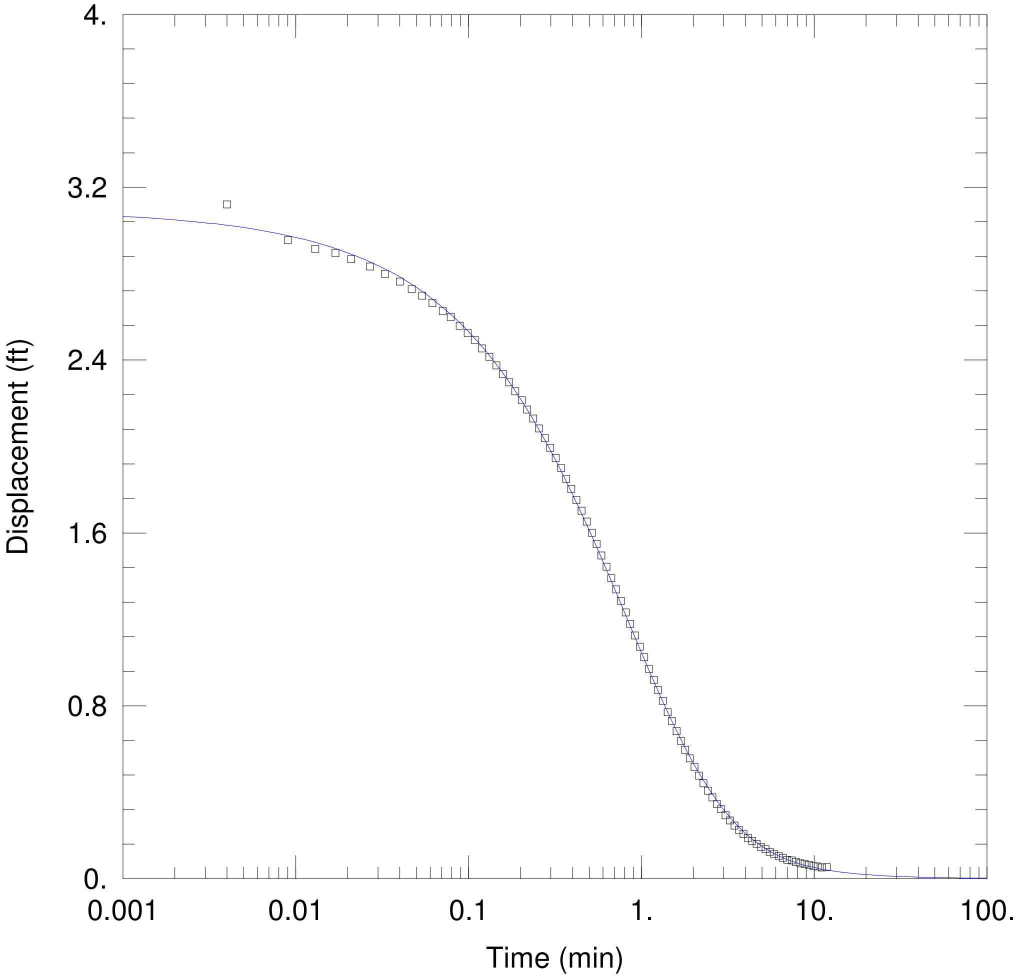
WELL DATA (PZ29D Bail)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 46.66 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.66 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.451 ft/day
y0 = 2.199 ft



TWIN PINES - PZ29D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ29D Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:23:57

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft

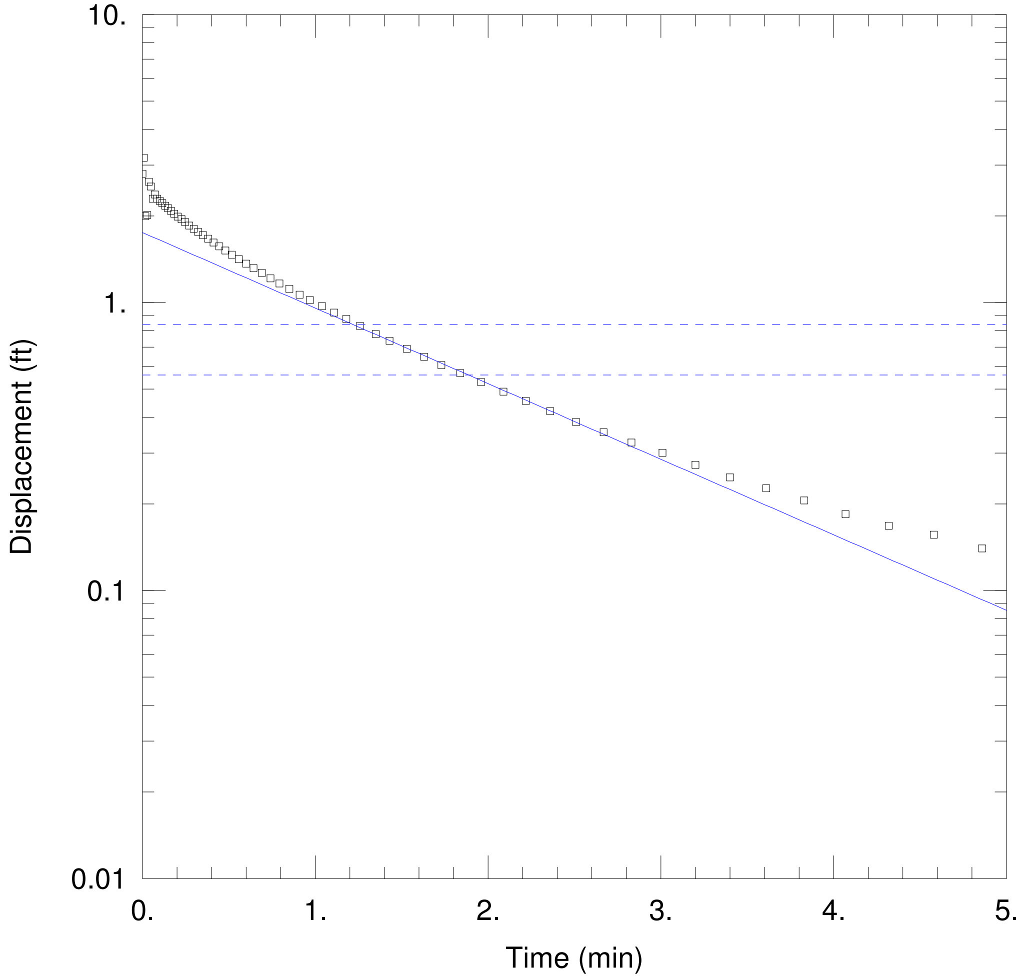
WELL DATA (PZ29D Bail)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 46.66 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.66 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.451 ft/day
Kz/Kr = 0.1
Ss = 0.0001322 ft^{-1}



TWIN PINES - PZ29D SLUGTEST

Data Set: H:\...\PZ29D Slug_BR_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:28:24

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

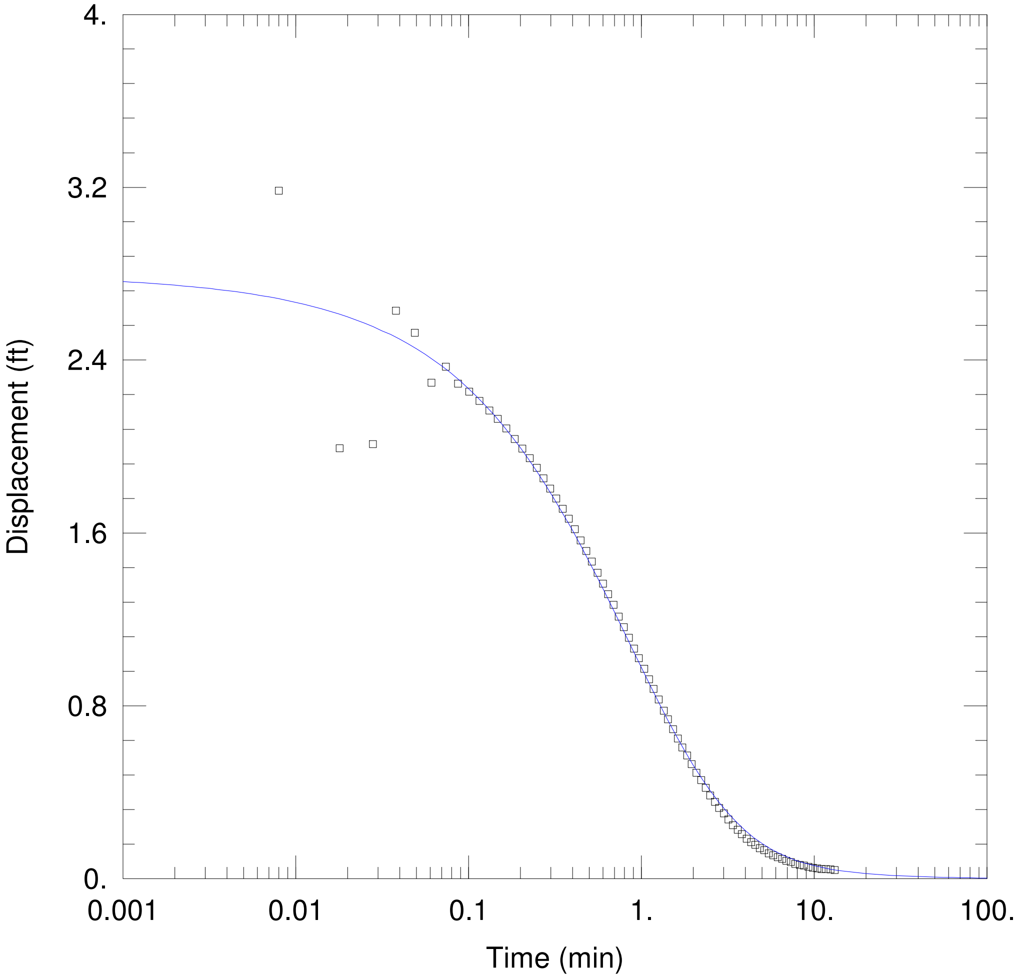
WELL DATA (PZ29D Slug)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 46.11 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.11 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.19 ft/day
y0 = 1.75 ft



TWIN PINES - PZ29D SLUGTEST

Data Set: H:\...\PZ29D Slug_KGS_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:28:52

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft

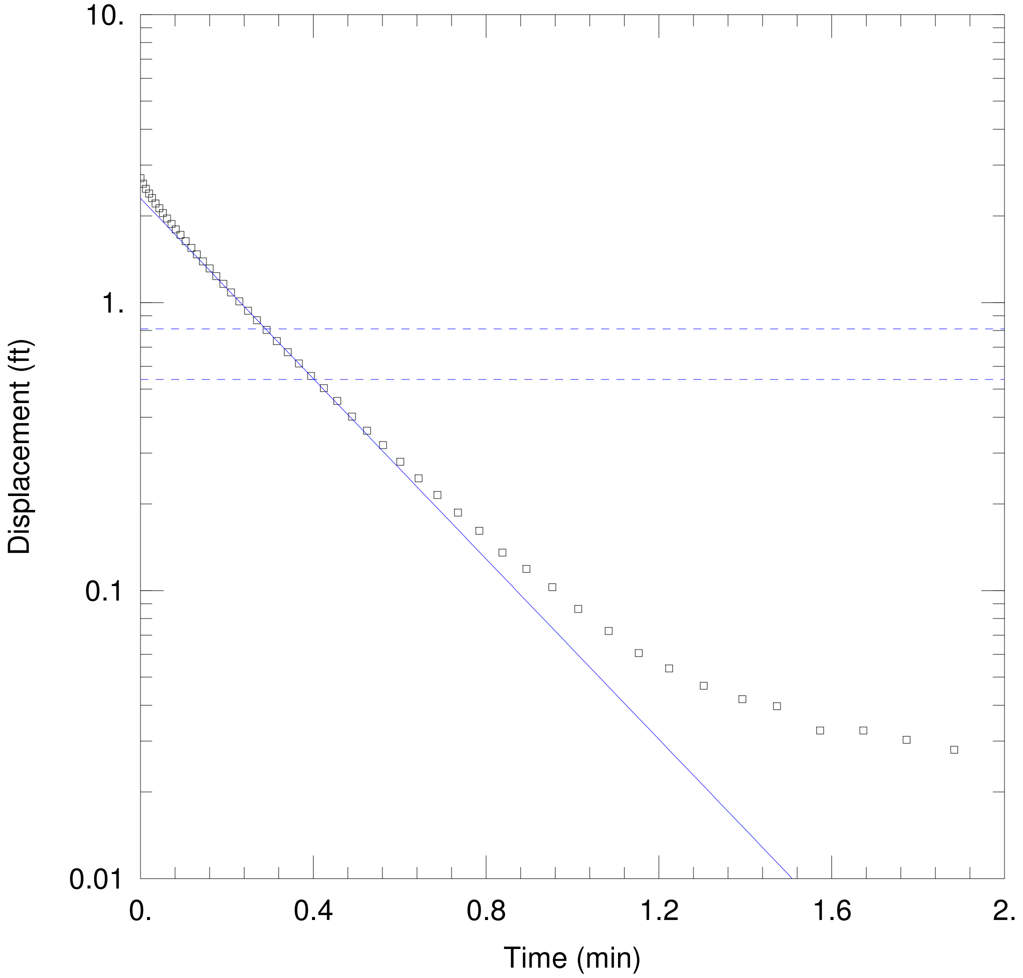
WELL DATA (PZ29D Slug)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 46.11 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.11 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.246 ft/day
Kz/Kr = 0.1
Ss = 0.0002284 ft^{-1}



TWIN PINES - PZ29S BAIL TEST

Data Set: H:\...\PZ29S Bail_BR_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:29:29

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

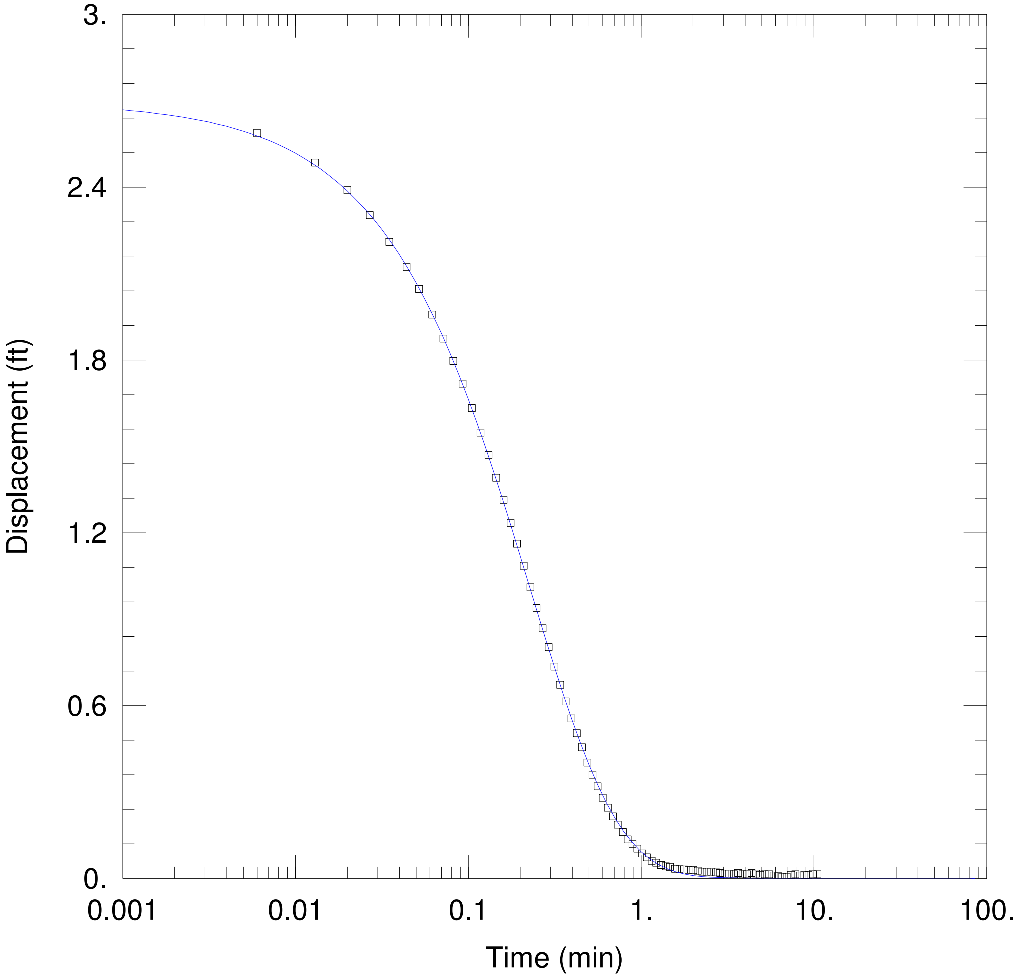
WELL DATA (PZ29S Bail)

Initial Displacement: 2.7 ft
Static Water Column Height: 15.89 ft
Total Well Penetration Depth: 15.89 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 6.24 ft/day
y0 = 2.3 ft



TWIN PINES - PZ29S BAIL TEST

Data Set: H:\...\PZ29S Bail_KGS_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:31:05

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft

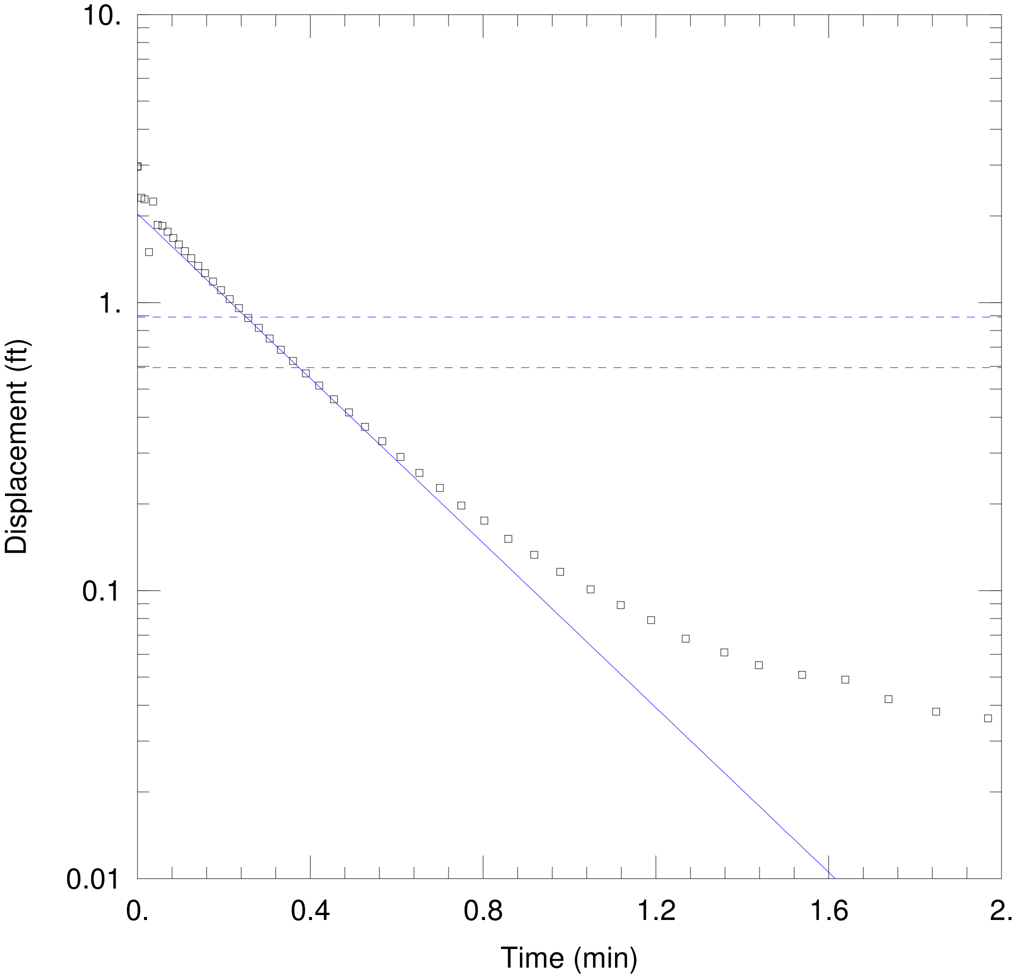
WELL DATA (PZ29S Bail)

Initial Displacement: 2.7 ft
Total Well Penetration Depth: 15.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.89 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 8.226 ft/day
Kz/Kr = 0.1
Ss = 7.007E-6 ft^{-1}



TWIN PINES - PZ29S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ29S Slug_BR_SJS.aqt
Date: 06/03/19 Time: 14:32:02

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

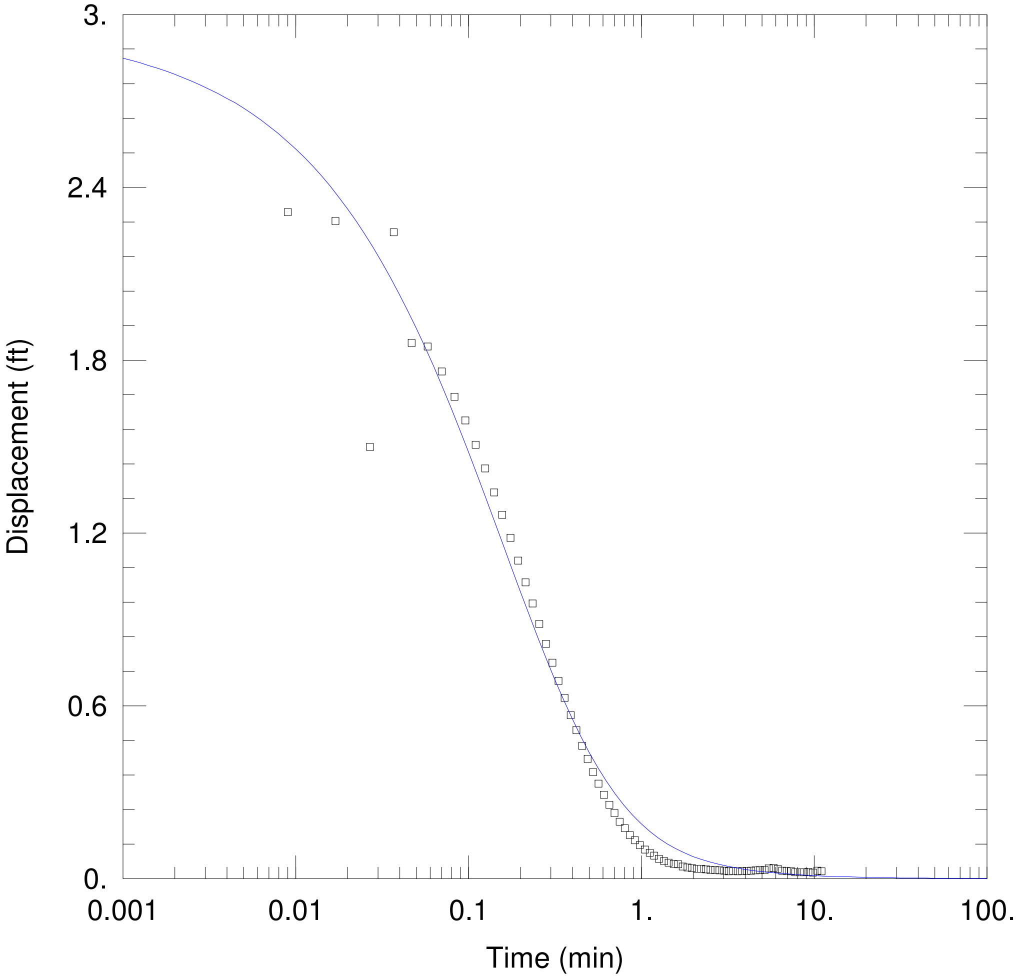
WELL DATA (PZ29S Slug)

Initial Displacement: 2.97 ft
Total Well Penetration Depth: 15.87 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.87 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.697 ft/day
y0 = 2.035 ft



TWIN PINES - PZ29S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ29S Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 14:32:28

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ29S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 85. ft

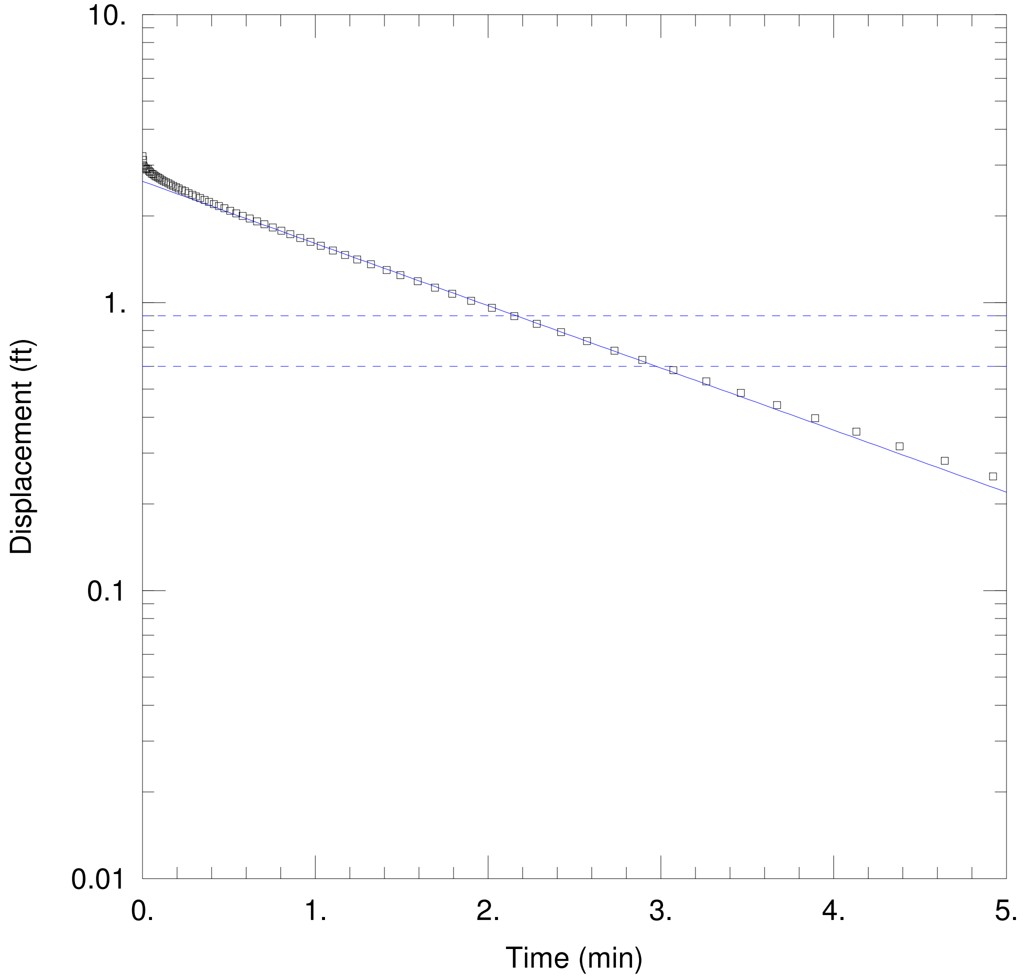
WELL DATA (PZ29S Slug)

Initial Displacement: 2.97 ft
Total Well Penetration Depth: 15.87 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.87 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 5.441 ft/day
Kz/Kr = 0.1
Ss = 0.0005129 ft^{-1}



TWIN PINES - PZ30D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30D Bail_BR_SJS.aqt
Date: 06/03/19
Time: 14:33:01

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft
Anisotropy Ratio (Kz/Kr): 0.1

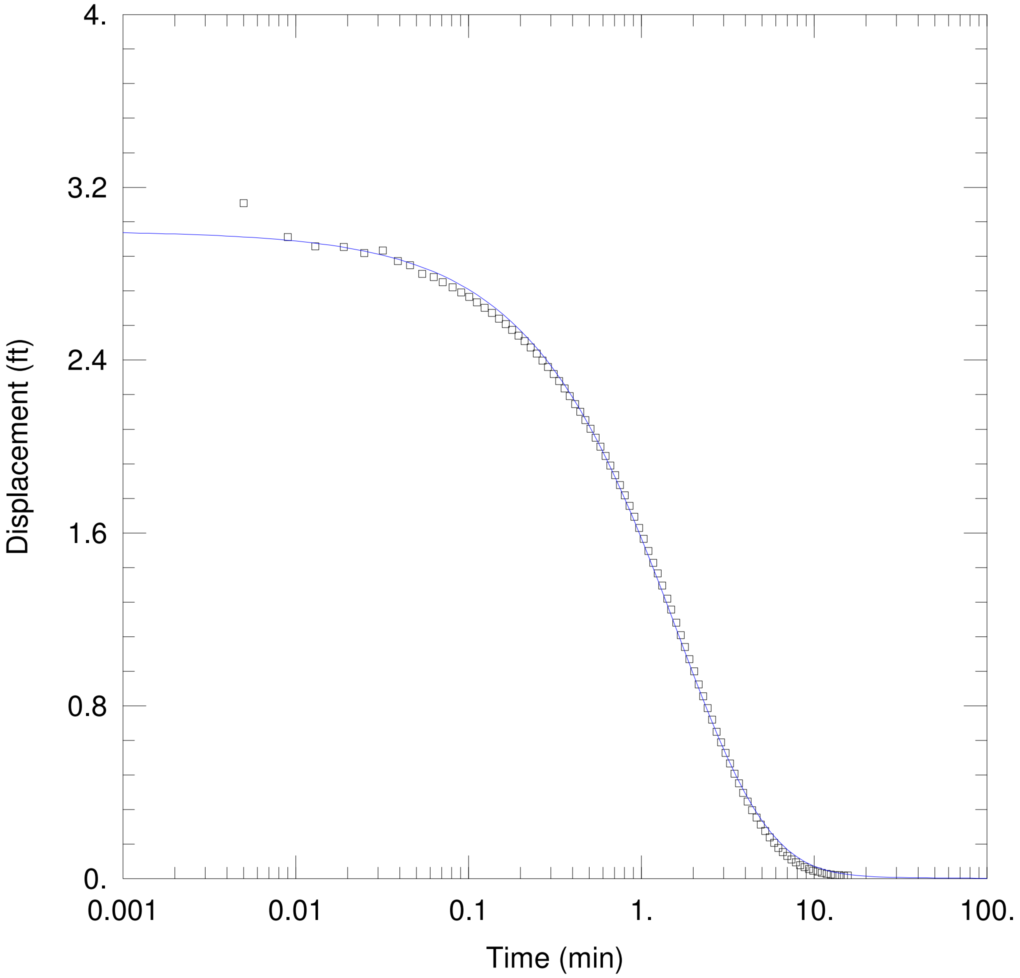
WELL DATA (PZ30D Bail)

Initial Displacement: 3. ft
Total Well Penetration Depth: 46.22 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.22 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.9893 ft/day
y0 = 2.635 ft



TWIN PINES - PZ30D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30D Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:33:56

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft

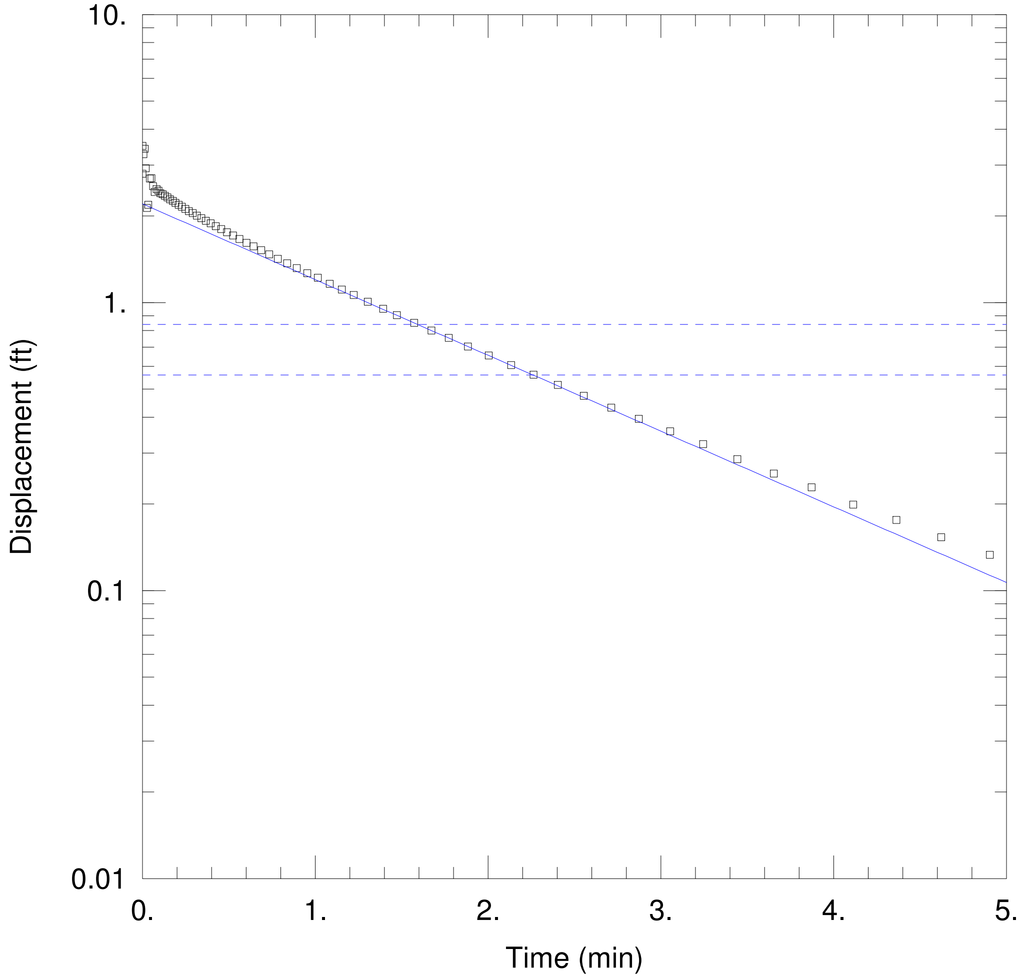
WELL DATA (PZ30D Bail)

Initial Displacement: 3. ft
Total Well Penetration Depth: 46.22 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.22 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.085 ft/day
Kz/Kr = 0.1
Ss = 1.142E-5 ft^{-1}



TWIN PINES - PZ30D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30D Slug_BR_SJS.aqt
Date: 06/03/19 Time: 14:34:55

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft
Anisotropy Ratio (Kz/Kr): 0.1

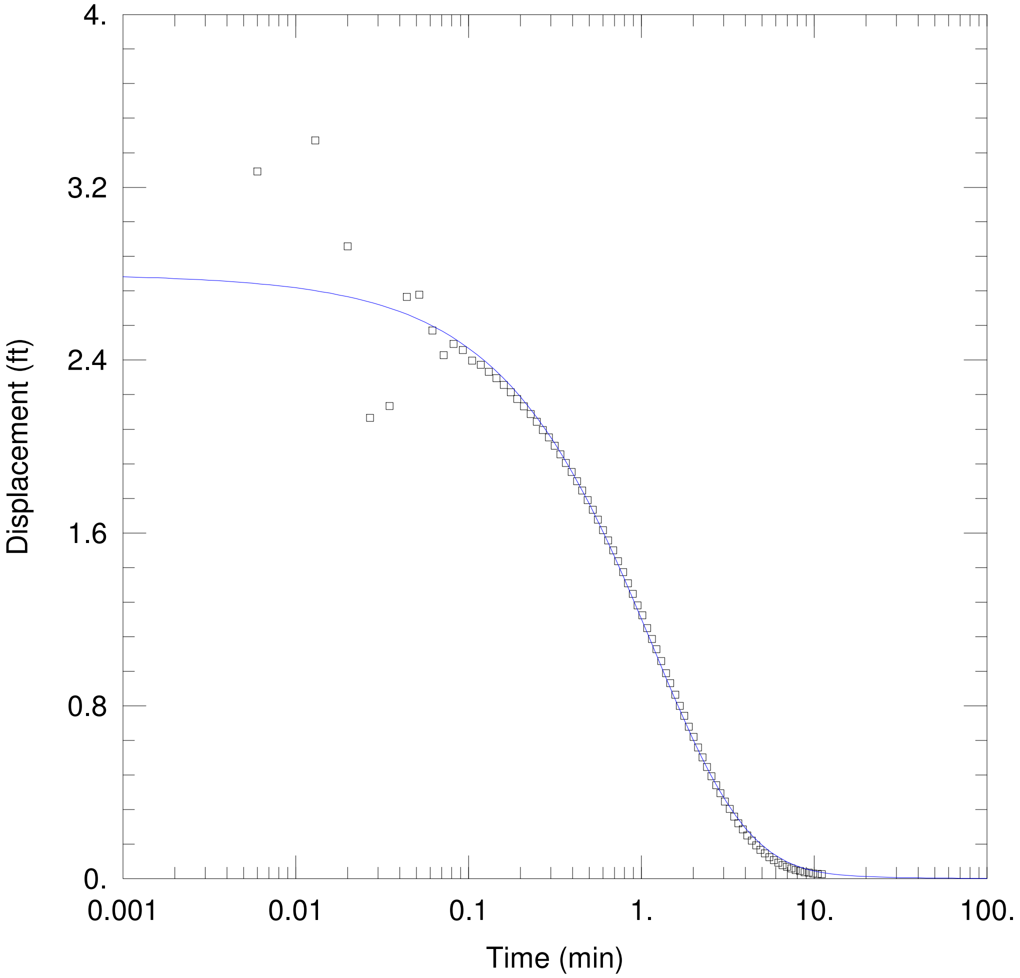
WELL DATA (PZ30D Slug)

Initial Displacement: 2.8 ft
Static Water Column Height: 46.2 ft
Total Well Penetration Depth: 46.2 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.205 ft/day
y0 = 2.2 ft



TWIN PINES - PZ30D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30D Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 14:36:23

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft

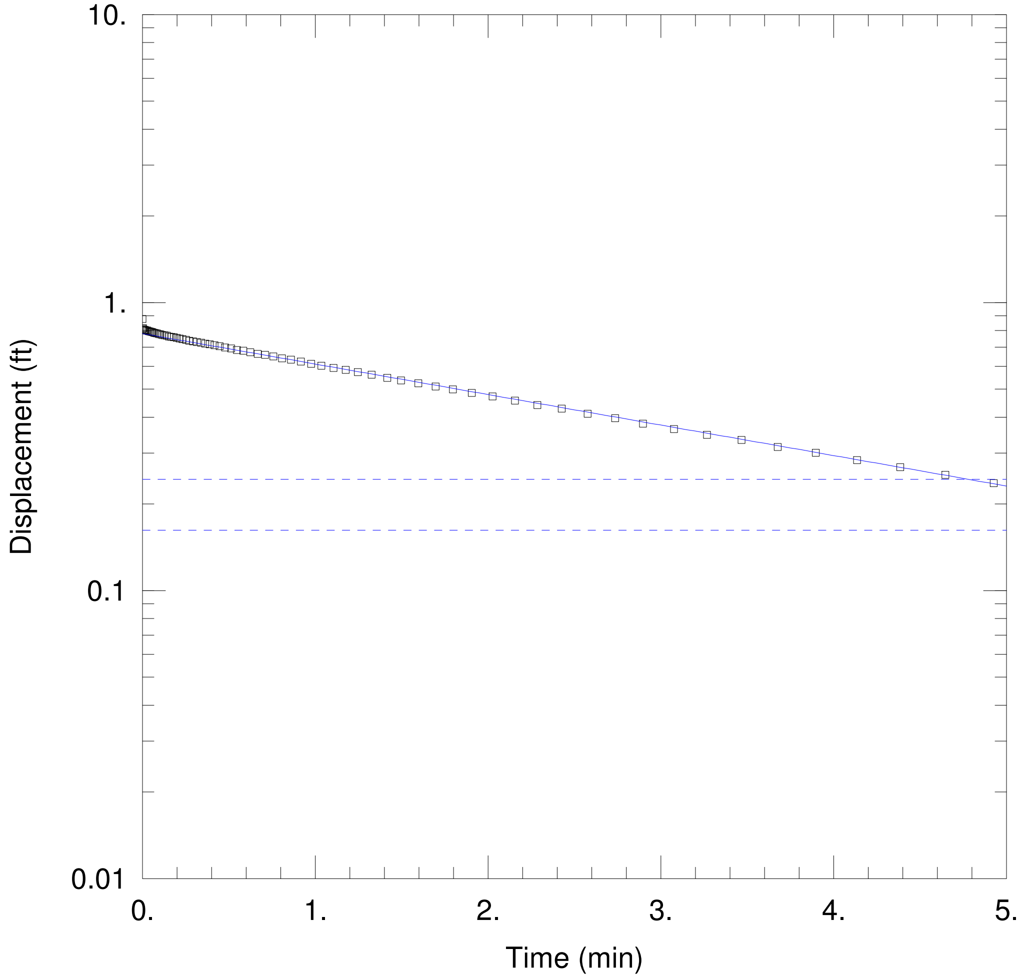
WELL DATA (PZ30D Slug)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 46.2 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.2 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.383 ft/day
Kz/Kr = 0.1
Ss = 2.232E-5 ft^{-1}



TWIN PINES - PZ30S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30S Bail_BR_SJS.aqt
Date: 06/03/19
Time: 15:09:49

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft
Anisotropy Ratio (Kz/Kr): 0.1

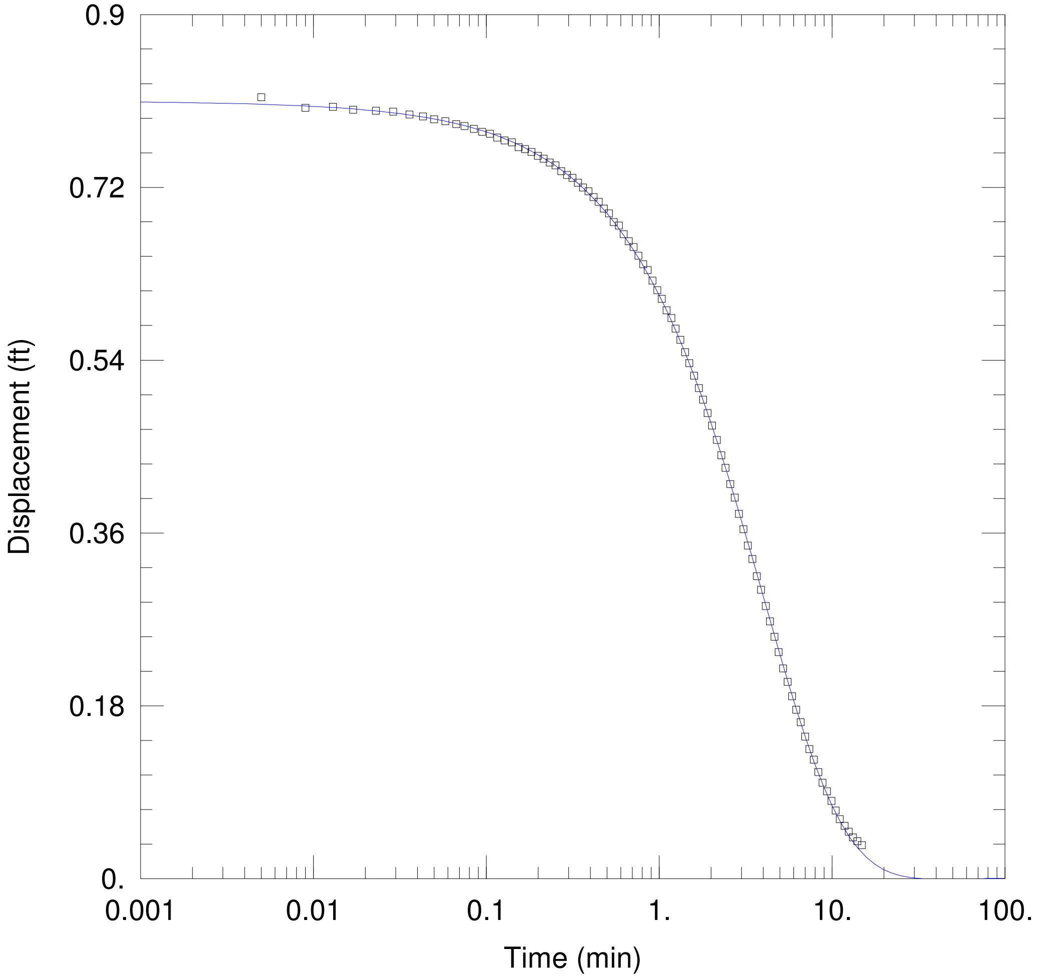
WELL DATA (PZ30S Bail)

Initial Displacement: 0.81 ft
Total Well Penetration Depth: 7.06 ft
Casing Radius: 0.083 ft
Static Water Column Height: 7.06 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.6862 ft/day
y0 = 0.7802 ft



TWIN PINES - PZ30S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ30S Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 15:10:33

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft

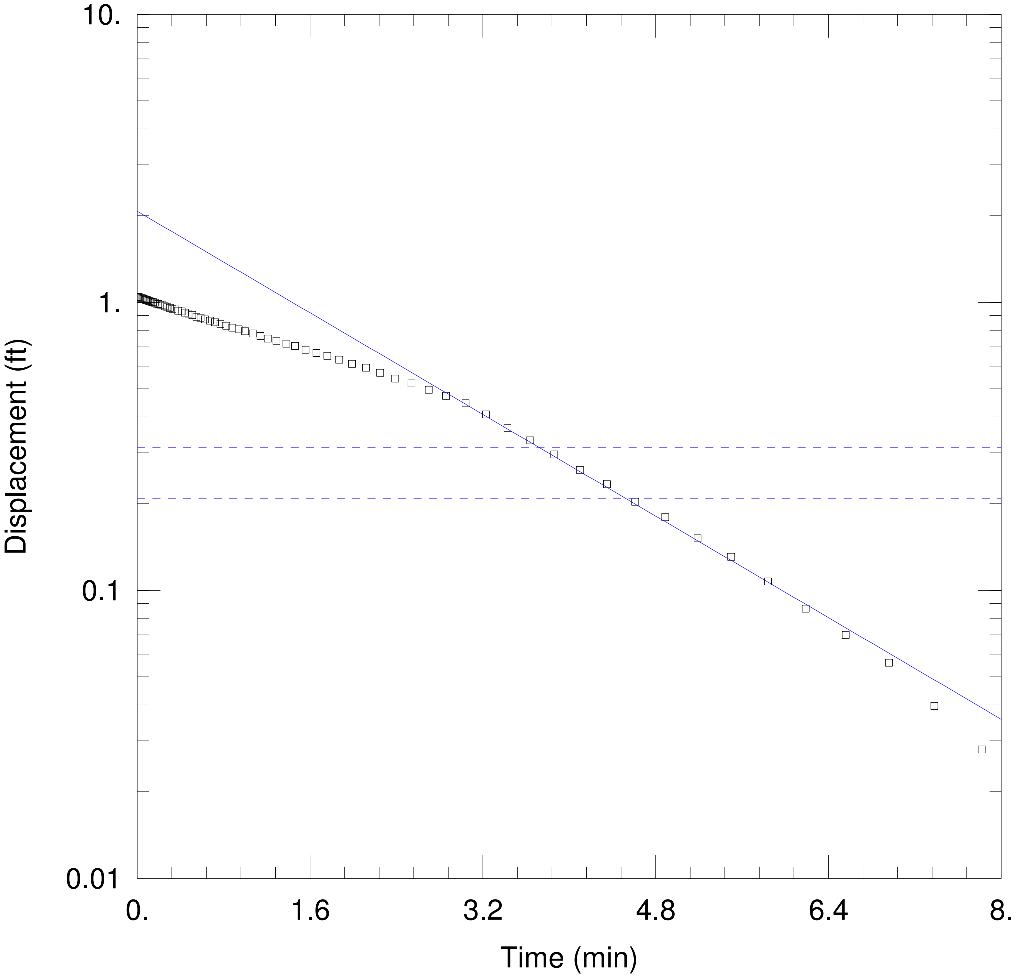
WELL DATA (PZ30S Bail)

Initial Displacement: 0.81 ft
Total Well Penetration Depth: 7.06 ft
Casing Radius: 0.083 ft
Static Water Column Height: 7.06 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.8683 ft/day
Kz/Kr = 0.1
Ss = 1.065E-5 ft^{-1}



TWIN PINES - PZ30S SLUGTEST

Data Set: H:\...\PZ30S Slug_BR_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:22:53

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30S Slug
Test Date: 5-16-19

AQUIFER DATA

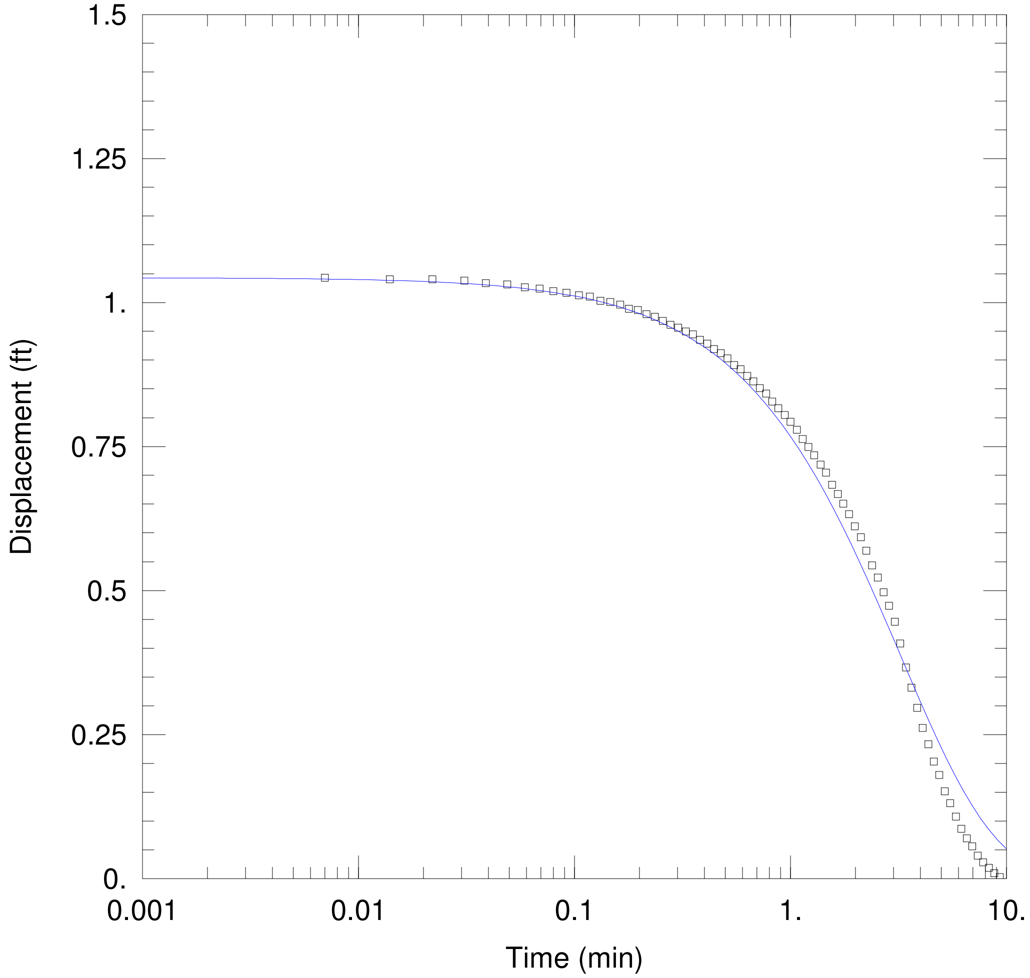
Saturated Thickness: 68. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ30S Slug)

Initial Displacement: 1.043 ft
Static Water Column Height: 7.08 ft
Total Well Penetration Depth: 7.08 ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.43 ft/day
y0 = 2.071 ft



TWIN PINES - PZ30S SLUGTEST

Data Set: H:\...\PZ30S Slug_KGS_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:23:25

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ30S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 68. ft

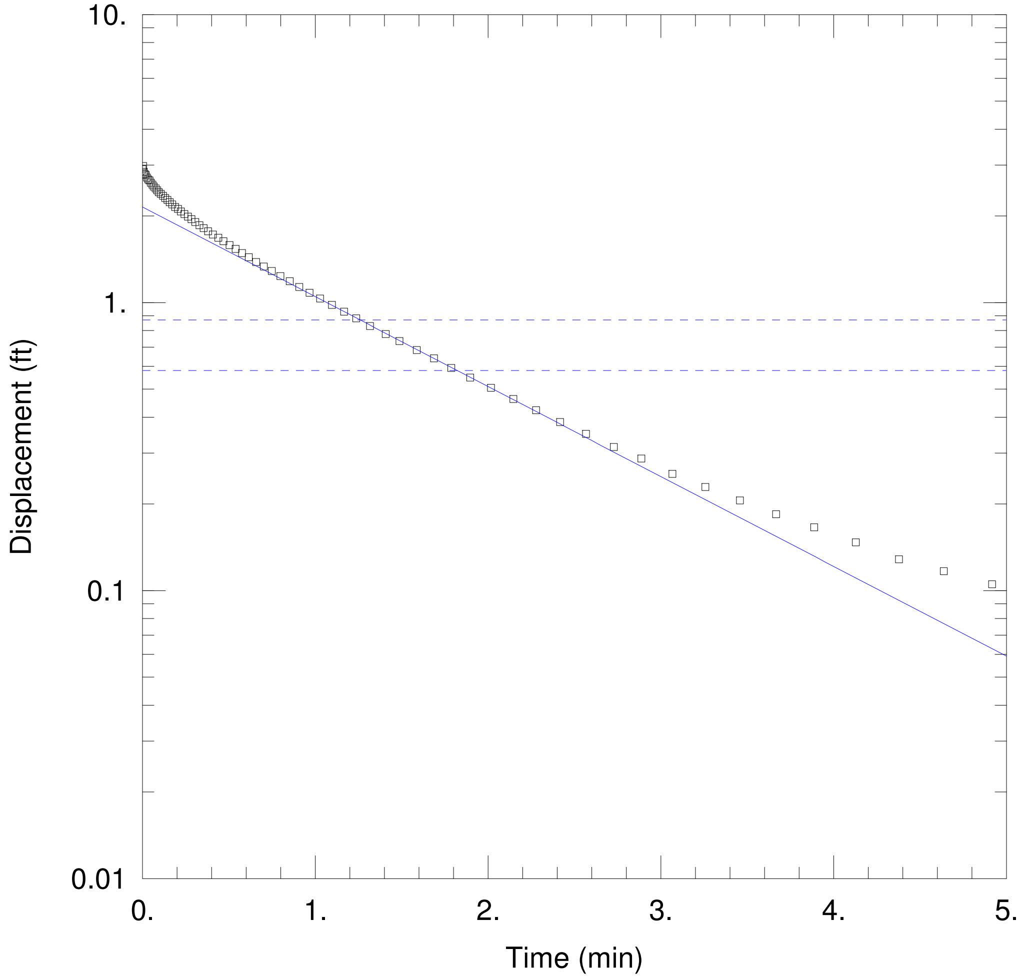
WELL DATA (PZ30S Slug)

Initial Displacement: 1.043 ft
Total Well Penetration Depth: 7.08 ft
Casing Radius: 0.083 ft
Static Water Column Height: 7.08 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.085 ft/day
Kz/Kr = 0.1
Ss = 1.967E-16 ft^{-1}



TWIN PINES - PZ31D BAIL TEST

Data Set: H:\...\PZ31D Bail_BR_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:39:19

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

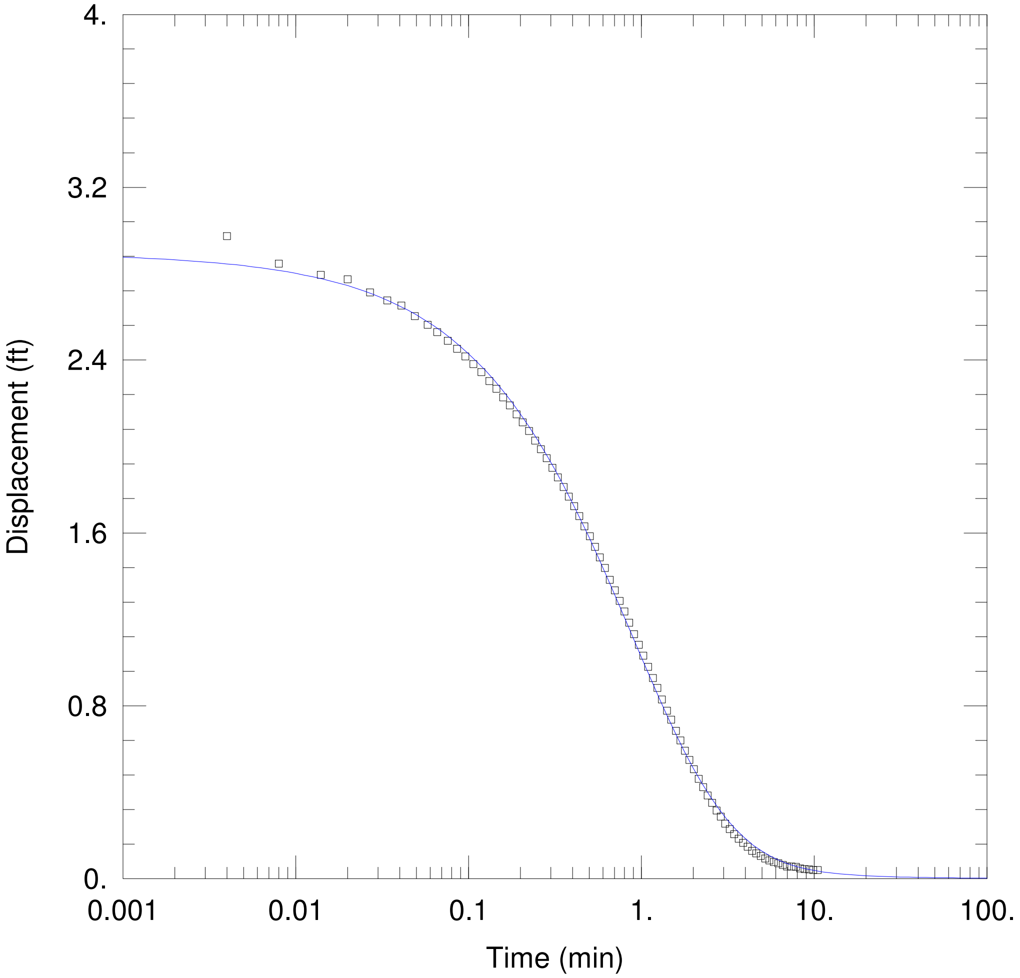
WELL DATA (PZ31D Bail)

Initial Displacement: 2.9 ft
Static Water Column Height: 46.1 ft
Total Well Penetration Depth: 46.1 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.498 ft/day
y0 = 2.149 ft



TWIN PINES - PZ31D BAIL TEST

Data Set: H:\...\PZ31D Bail_KGS_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:39:54

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft

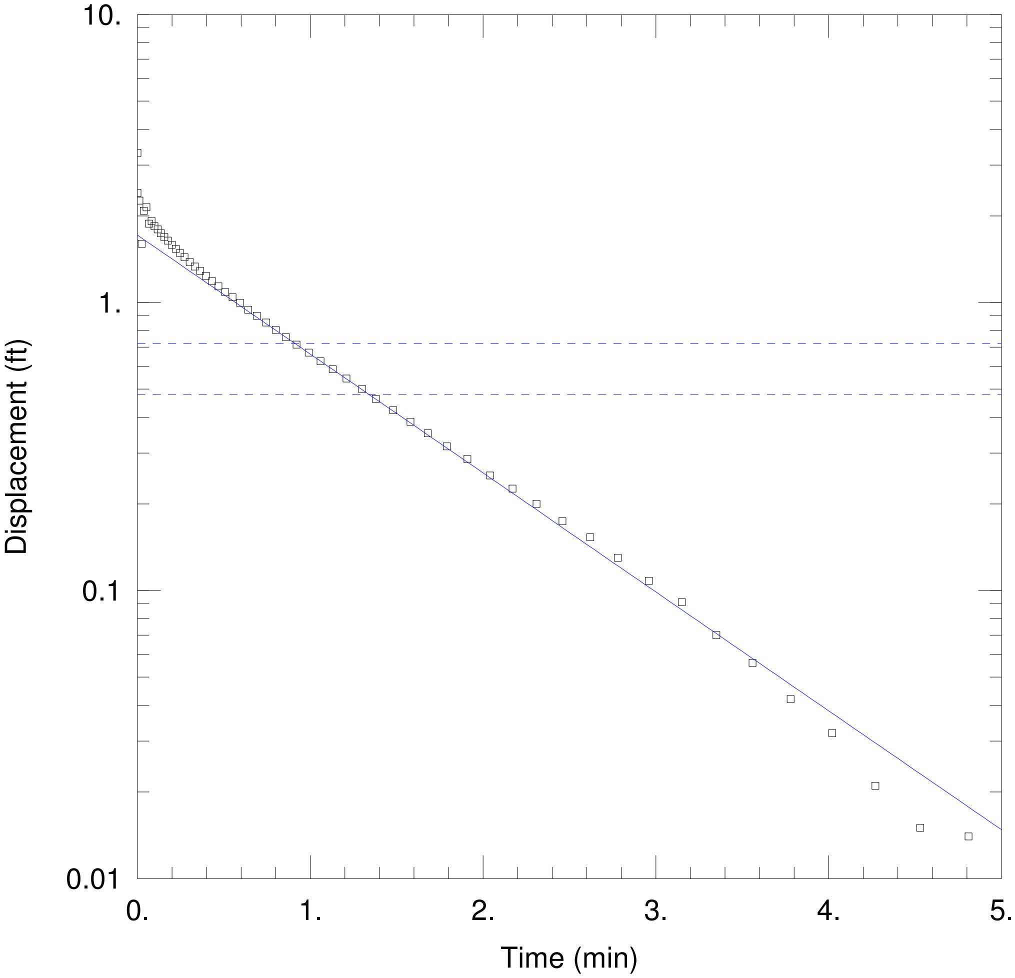
WELL DATA (PZ31D Bail)

Initial Displacement: 2.9 ft
Total Well Penetration Depth: 46.1 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.1 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.568 ft/day
Kz/Kr = 0.1
Ss = 5.938E-5 ft^{-1}



TWIN PINES - PZ31D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31D Slug_BR_SJS.aqt
Date: 06/03/19 Time: 15:11:20

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

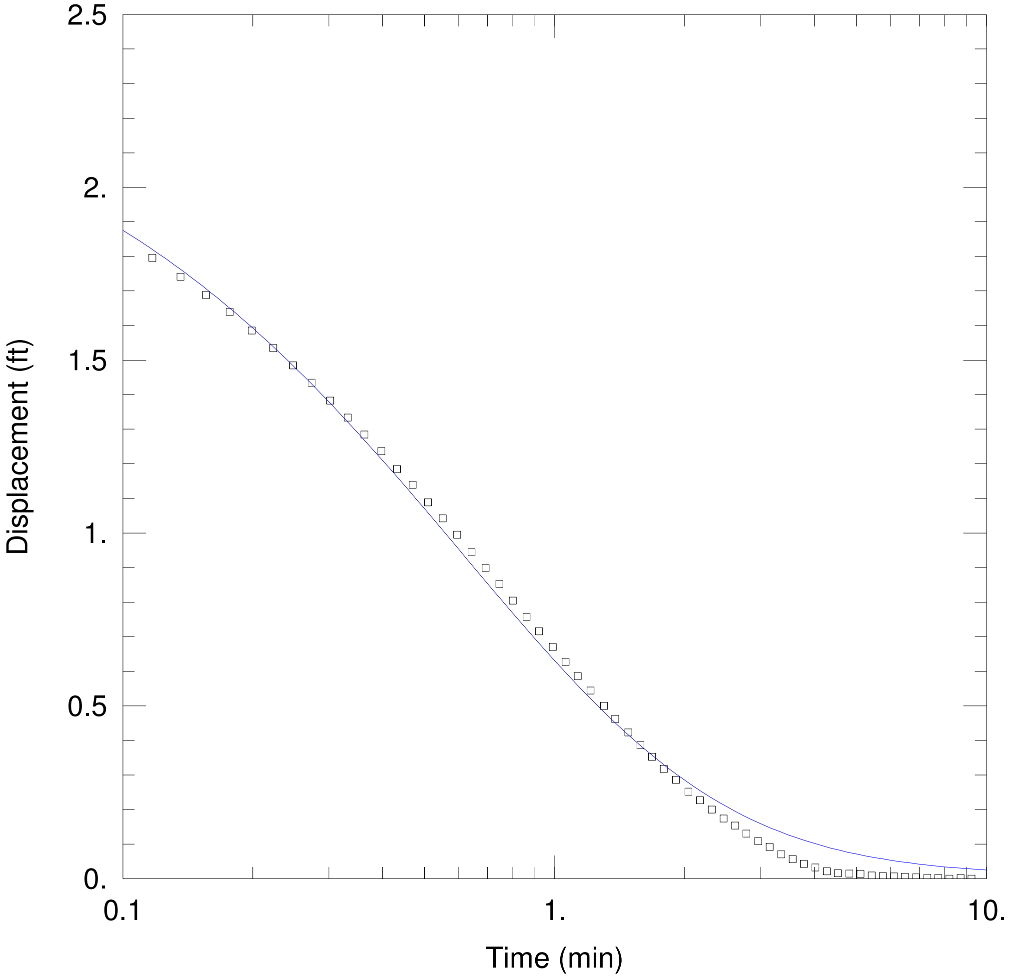
WELL DATA (PZ31D Slug)

Initial Displacement: 2.4 ft
Static Water Column Height: 46.06 ft
Total Well Penetration Depth: 46.06 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.981 ft/day
y0 = 1.713 ft



TWIN PINES - PZ31D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31D Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 15:11:49

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft

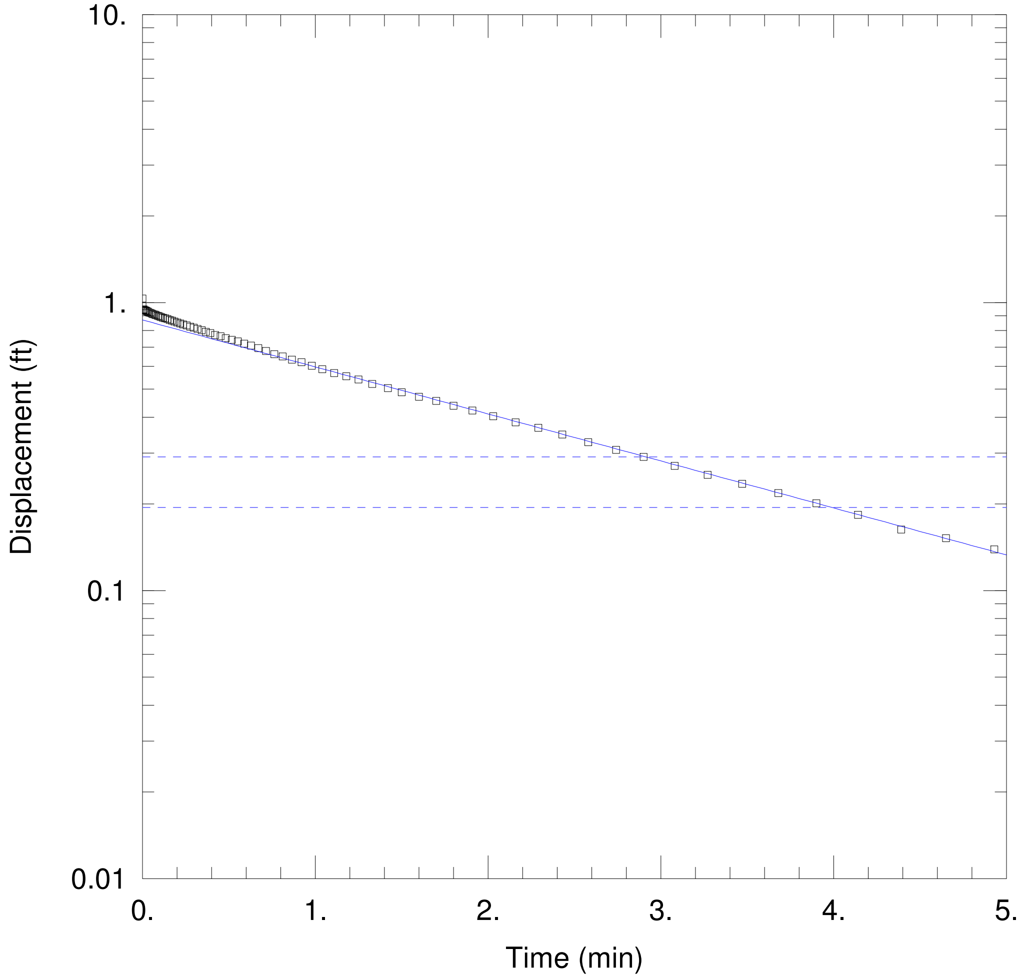
WELL DATA (PZ31D Slug)

Initial Displacement: 2.4 ft
Total Well Penetration Depth: 46.06 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.06 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 1.981 ft/day
Kz/Kr = 0.1
Ss = 0.0001215 ft^{-1}



TWIN PINES - PZ31S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31S Bail_BR_SJS.aqt
Date: 06/03/19 Time: 14:40:27

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

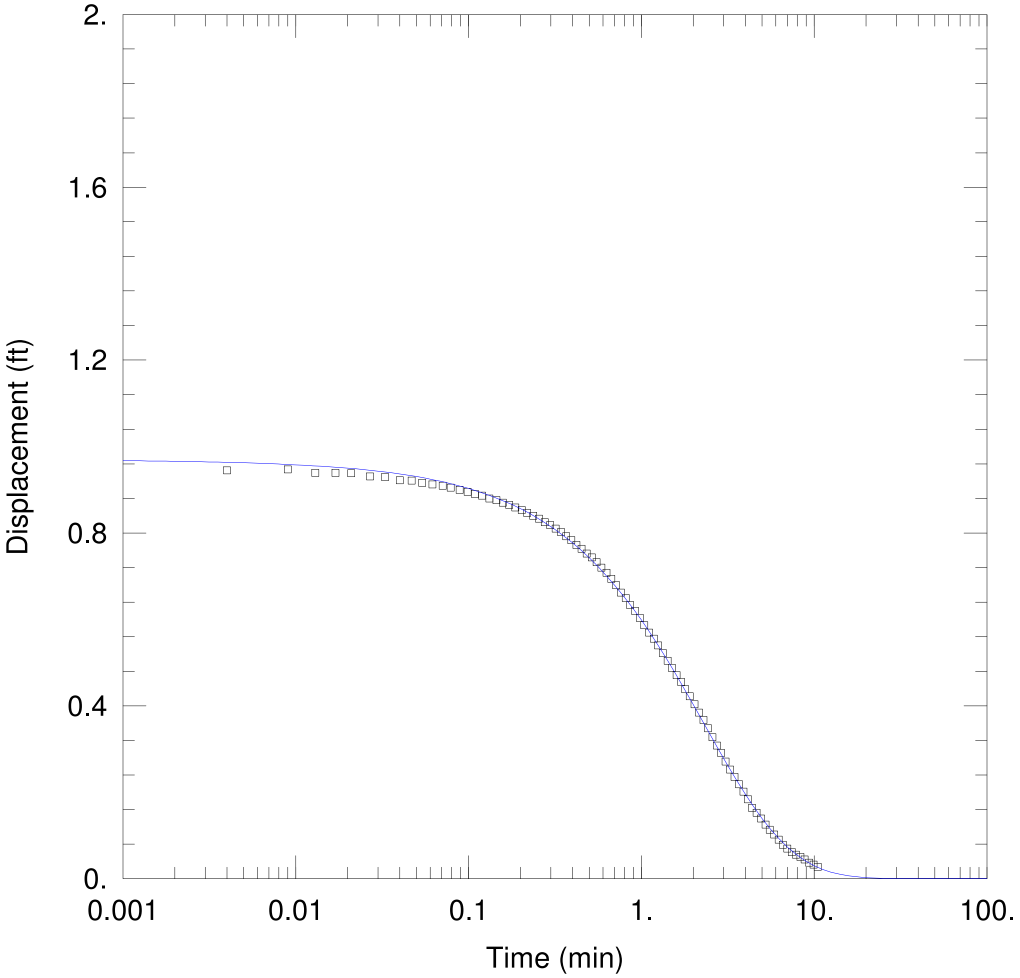
WELL DATA (PZ31S Bail)

Initial Displacement: 0.97 ft
Static Water Column Height: 8. ft
Total Well Penetration Depth: 8. ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.078 ft/day
y0 = 0.87 ft



TWIN PINES - PZ31S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31S Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:40:53

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft

WELL DATA (PZ31S Bail)

Initial Displacement: 0.97 ft
Total Well Penetration Depth: 8. ft
Casing Radius: 0.083 ft

Static Water Column Height: 8. ft
Screen Length: 5. ft
Well Radius: 0.25 ft

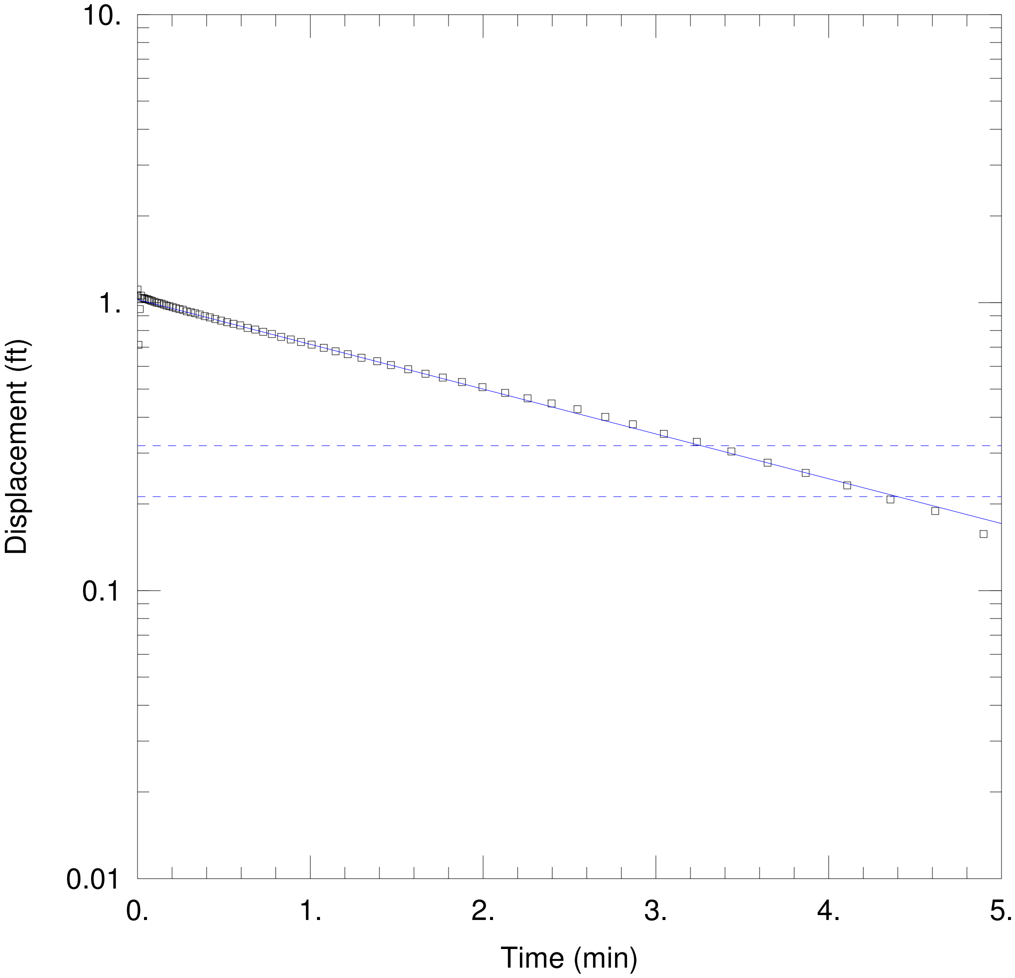
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 1.421 ft/day
Kz/Kr = 0.1

Ss = 2.693E-5 ft^{-1}



TWIN PINES - PZ31S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31S Slug_BR_SJS.aqt
Date: 06/03/19
Time: 15:21:45

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

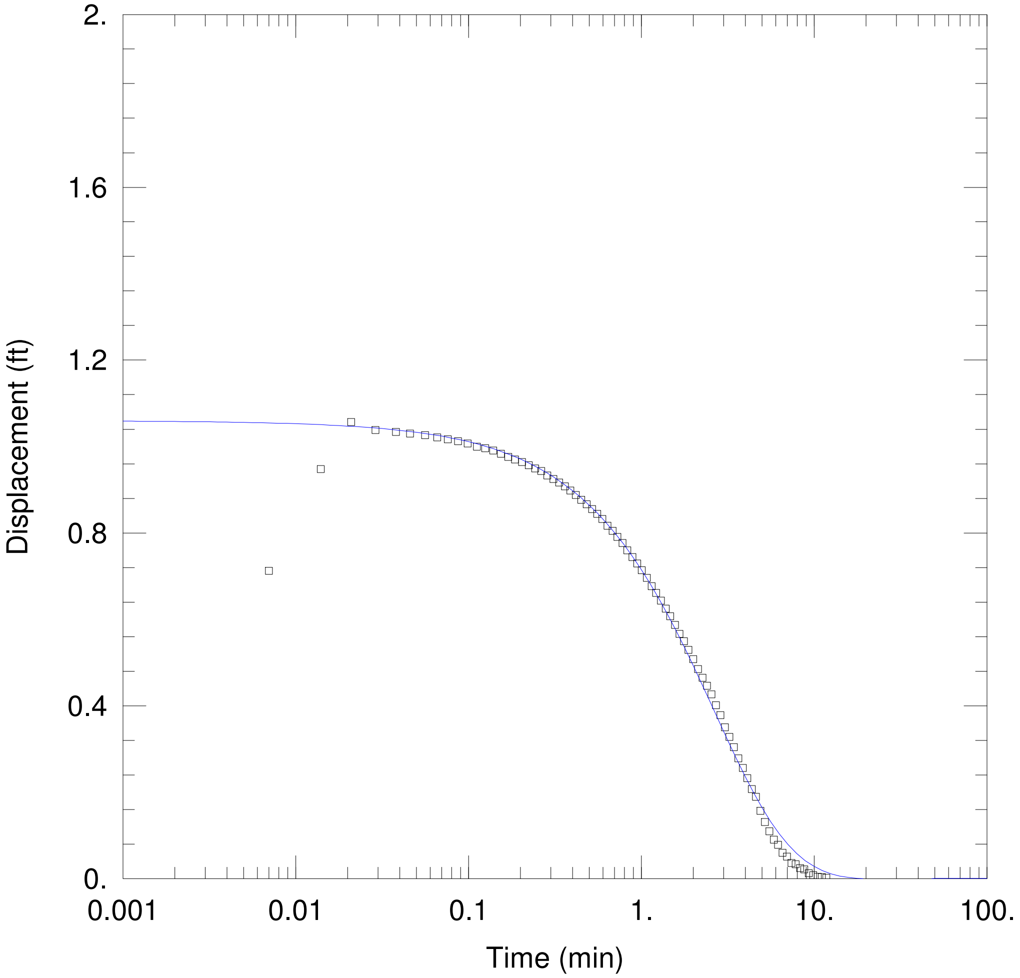
WELL DATA (PZ31S Slug)

Initial Displacement: 1.06 ft
Static Water Column Height: 8. ft
Total Well Penetration Depth: 8. ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.028 ft/day
y0 = 1.024 ft



TWIN PINES - PZ31S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ31S Slug_KGS_SJS.aqt
Date: 06/04/19 Time: 16:03:03

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ31S Slug
Test Date: 5-16-19

AQUIFER DATA

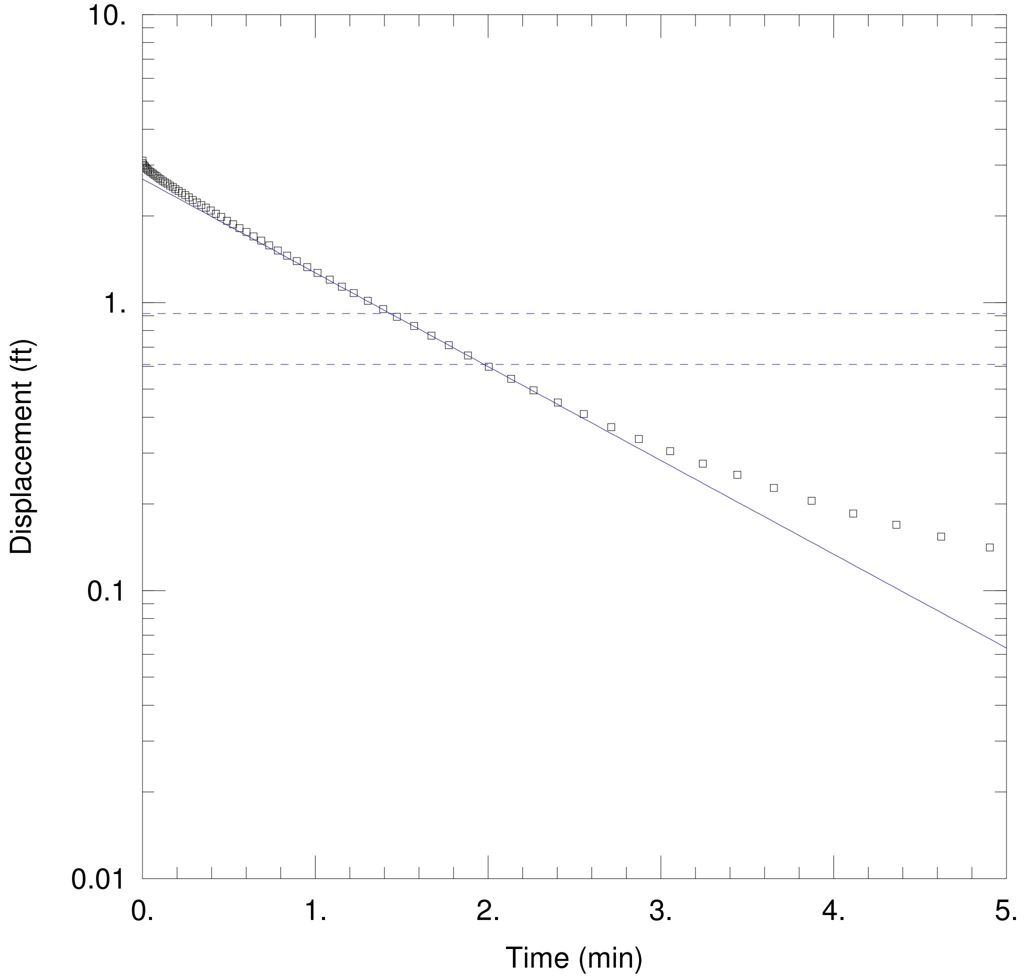
Saturated Thickness: 50. ft

WELL DATA (PZ31S Slug)

Initial Displacement: 1.06 ft	Static Water Column Height: 8. ft
Total Well Penetration Depth: 8. ft	Screen Length: 5. ft
Casing Radius: 0.083 ft	Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined	Solution Method: KGS Model
Kr = 1.355 ft/day	Ss = 2.335E-6 ft^{-1}
Kz/Kr = 0.1	



TWIN PINES - PZ33D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33D Bail_BR_SJS.aqt
Date: 06/03/19 Time: 14:41:26

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft
Anisotropy Ratio (Kz/Kr): 0.1

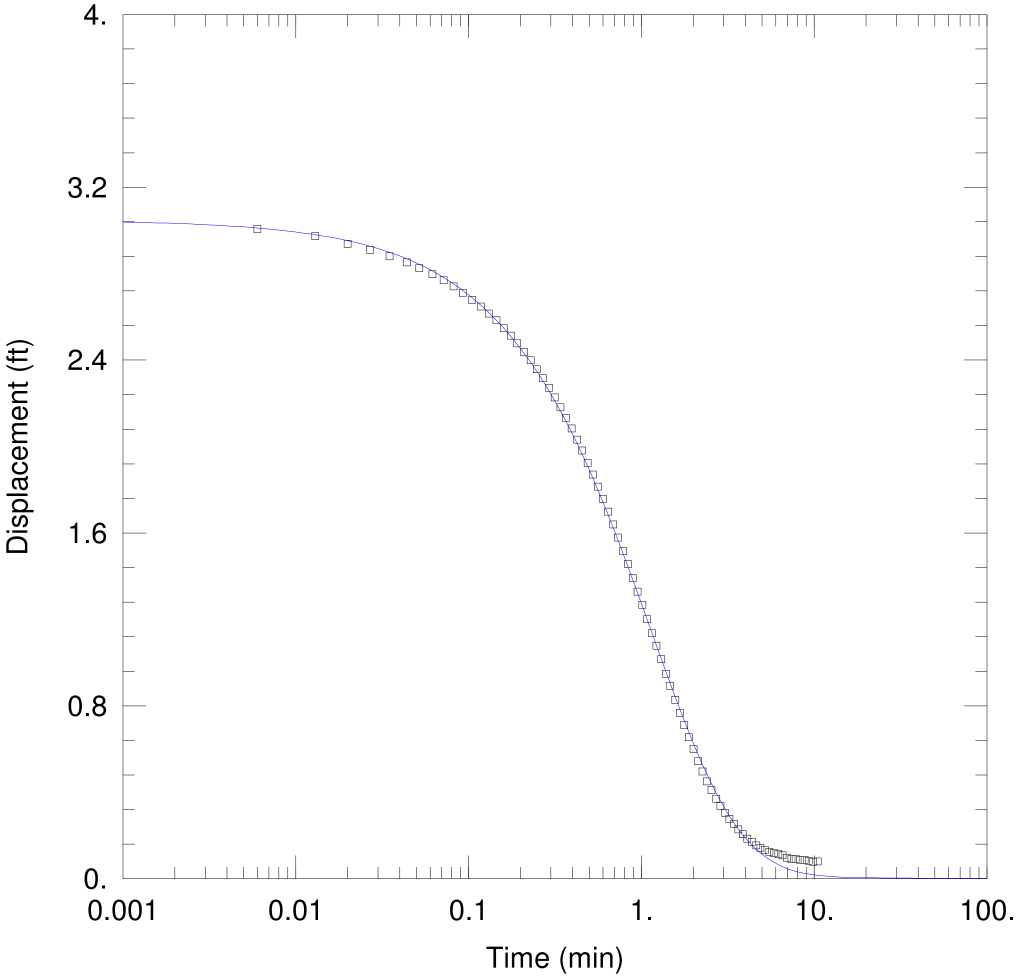
WELL DATA (PZ33D Bail)

Initial Displacement: 3.05 ft
Total Well Penetration Depth: 46.99 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.99 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.748 ft/day
y0 = 2.683 ft



TWIN PINES - PZ33D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33D Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:41:50

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft

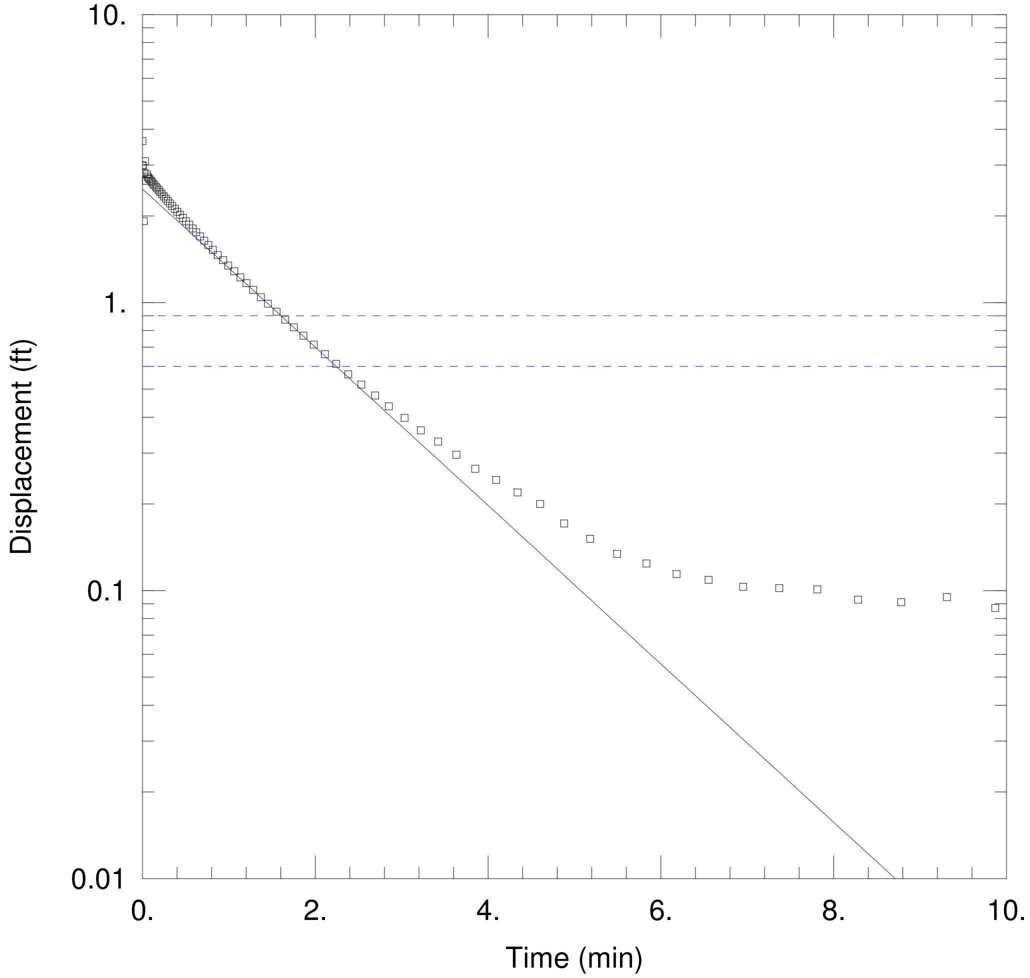
WELL DATA (PZ33D Bail)

Initial Displacement: 3.05 ft
Total Well Penetration Depth: 46.99 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.99 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.771 ft/day
Kz/Kr = 0.1
Ss = 8.216E-6 ft^{-1}



TWIN PINES - PZ33D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33D Slug_BR_SJS.aqt
Date: 06/03/19
Time: 14:42:30

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33D Slug
Test Date: 5-16-19

AQUIFER DATA

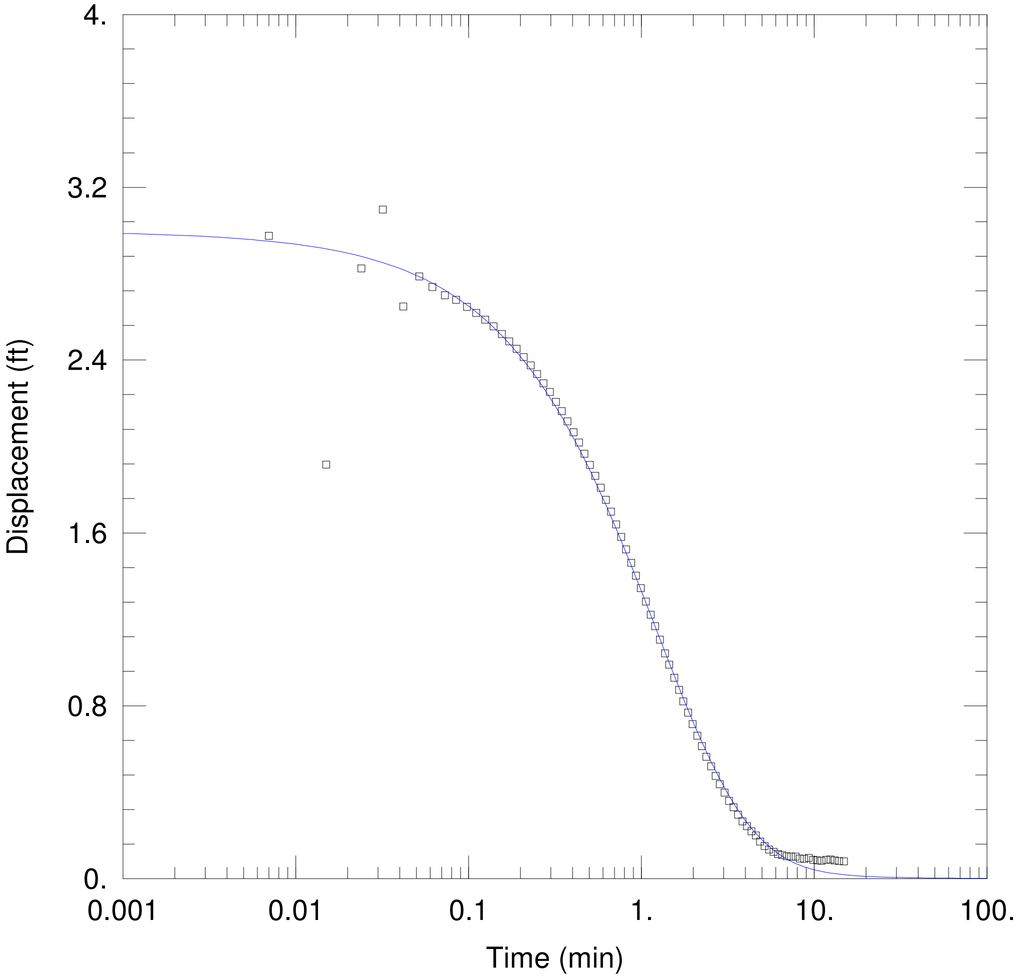
Saturated Thickness: 44. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ33D Slug)

Initial Displacement: 3. ft
Static Water Column Height: 46.91 ft
Total Well Penetration Depth: 46.91 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.475 ft/day
y0 = 2.48 ft



TWIN PINES - PZ33D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33D Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 14:43:05

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft

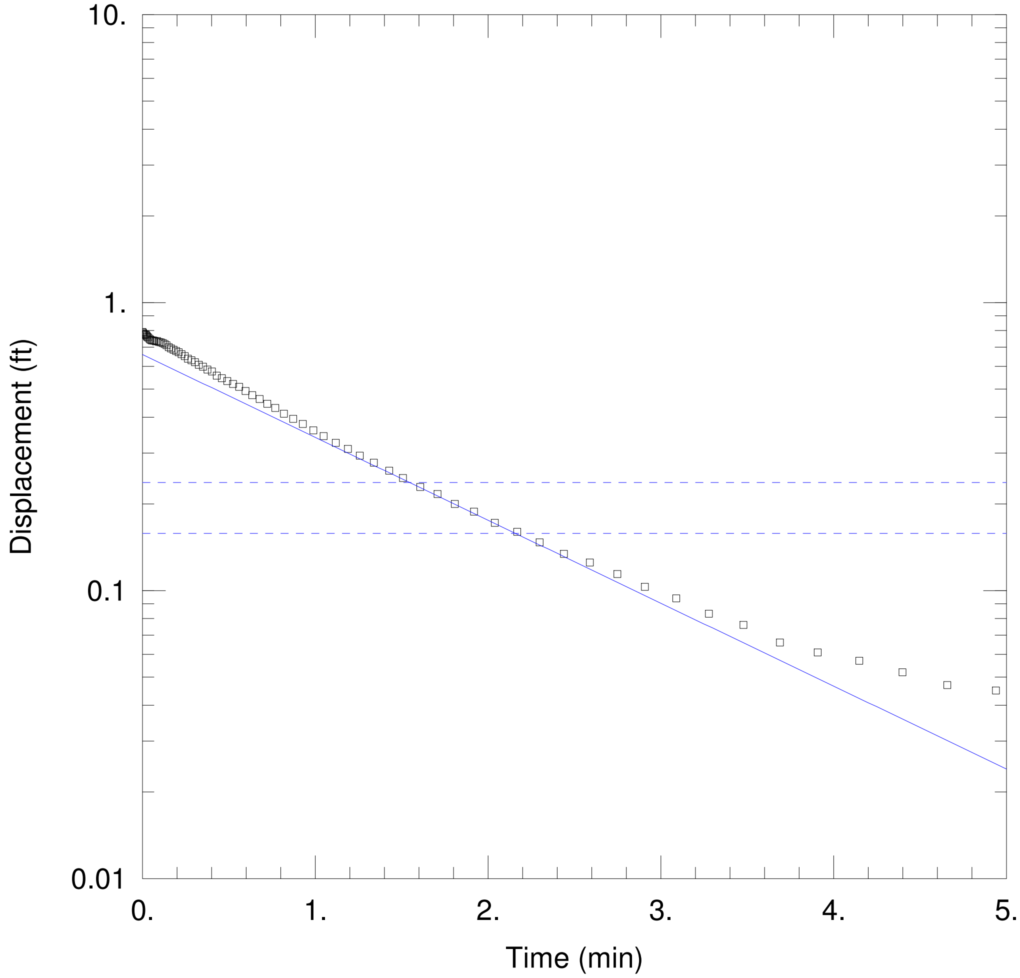
WELL DATA (PZ33D Slug)

Initial Displacement: 3. ft
Total Well Penetration Depth: 46.91 ft
Casing Radius: 0.083 ft
Static Water Column Height: 46.91 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.233 ft/day
Kz/Kr = 0.1
Ss = 2.553E-5 ft^{-1}



TWIN PINES - PZ33S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33S Bail_BR_SJS.aqt
Date: 06/03/19 Time: 14:43:32

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft
Anisotropy Ratio (Kz/Kr): 0.1

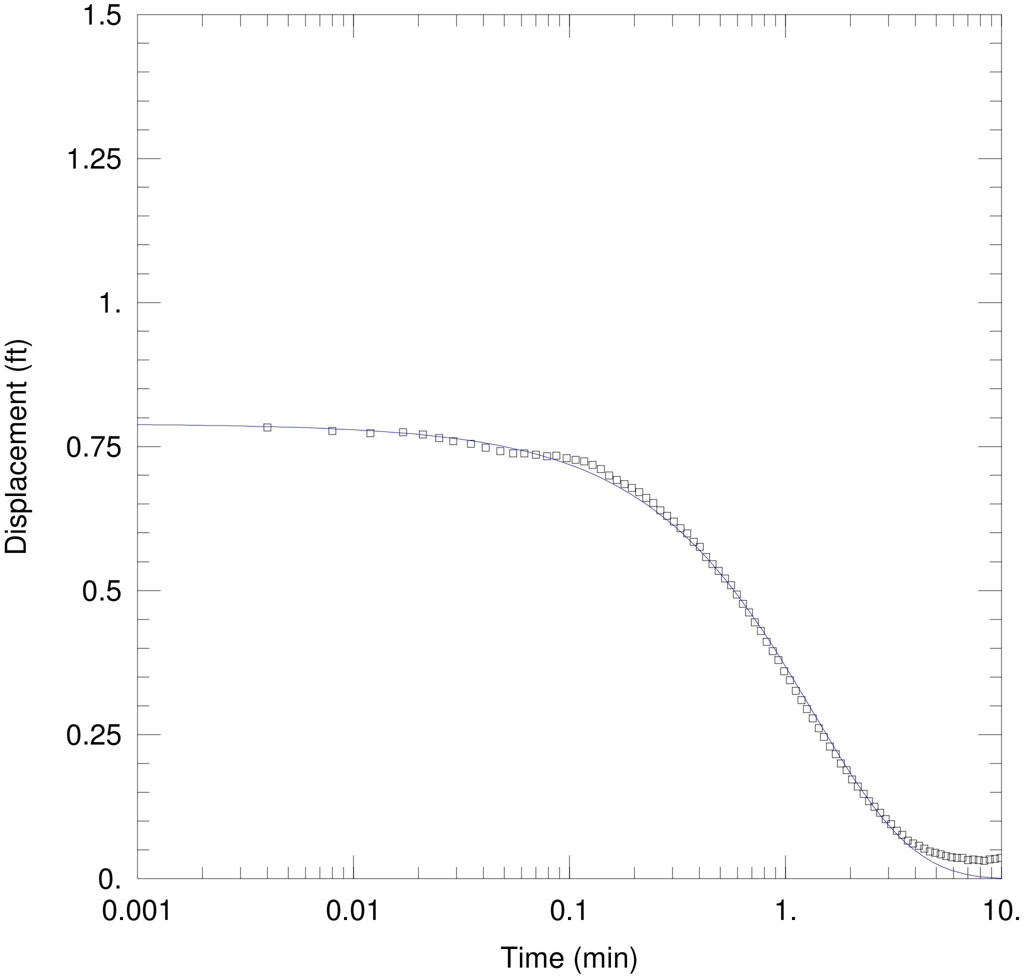
WELL DATA (PZ33S Bail)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 8.74 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.74 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.926 ft/day
y0 = 0.66 ft



TWIN PINES - PZ33S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33S Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:44:10

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft

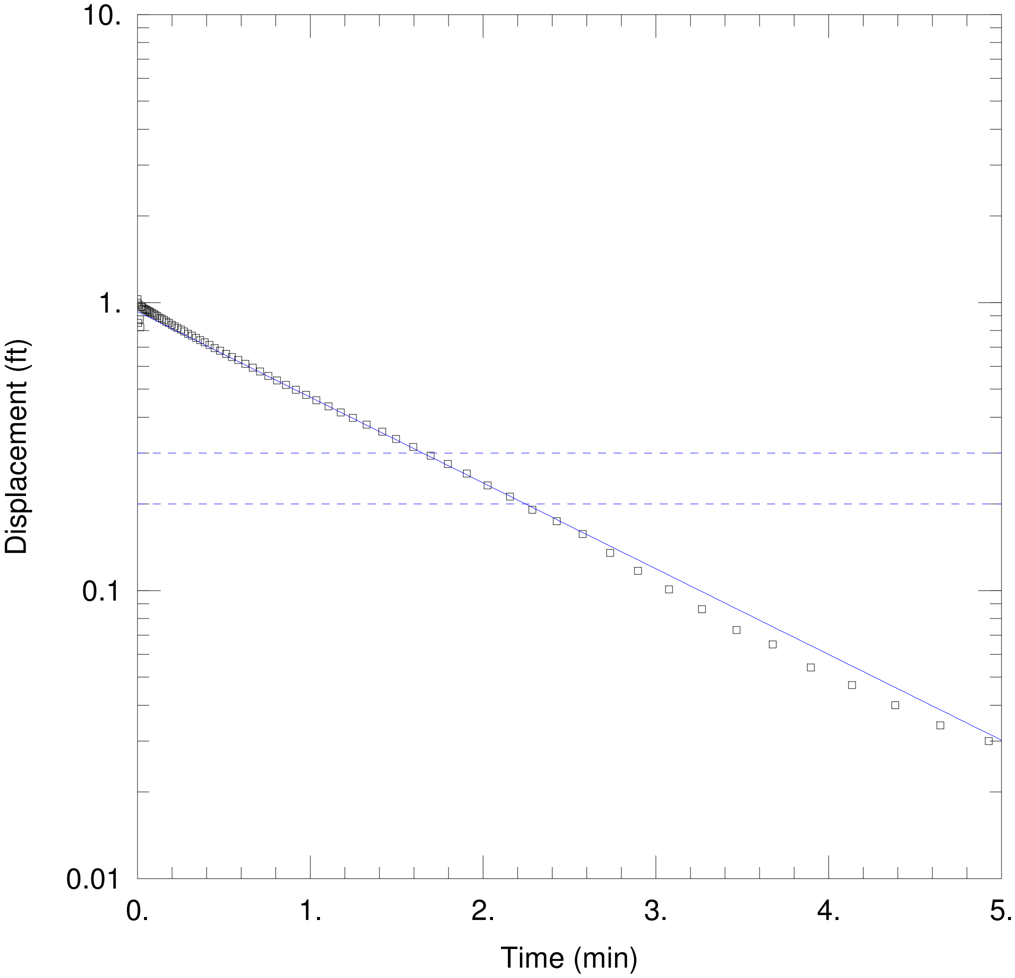
WELL DATA (PZ33S Bail)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 8.74 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.74 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.659 ft/day
Kz/Kr = 0.1
Ss = 5.852E-6 ft^{-1}



TWIN PINES - PZ33S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33S Slug_BR_SJS.aqt
Date: 06/03/19 Time: 14:44:39

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft
Anisotropy Ratio (Kz/Kr): 0.1

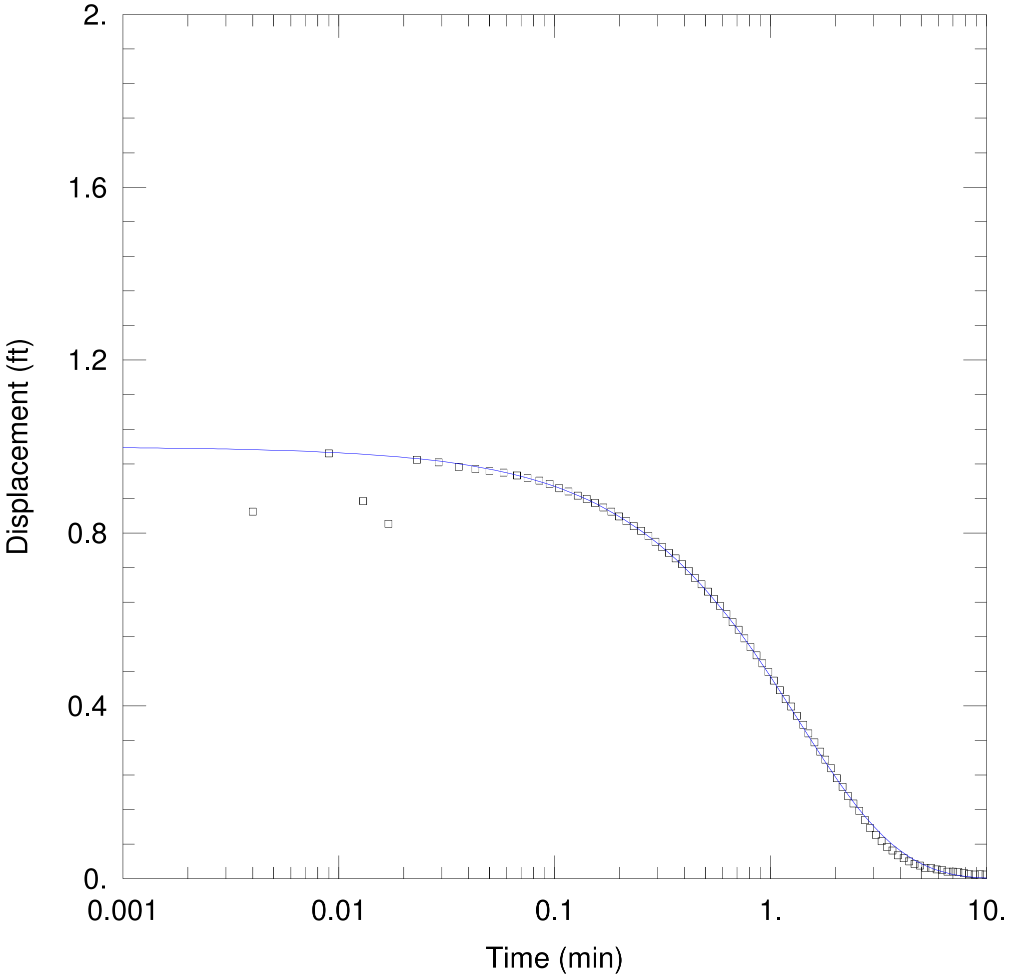
WELL DATA (PZ33S Slug)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.71 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.71 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.991 ft/day
y0 = 0.9305 ft



TWIN PINES - PZ33S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ33S Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 14:45:05

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ33S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 44. ft

WELL DATA (PZ33S Slug)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.71 ft
Casing Radius: 0.083 ft

Static Water Column Height: 8.71 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

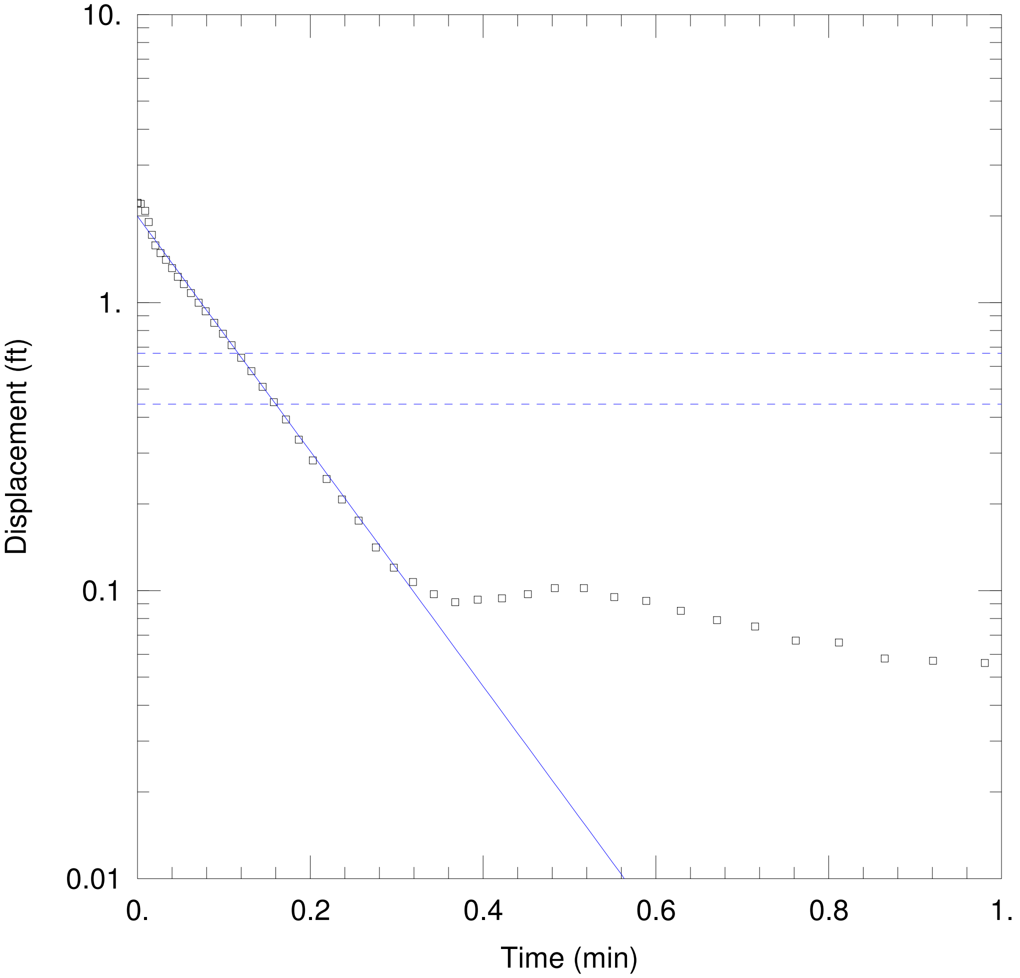
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 2.625 ft/day
Kz/Kr = 0.1

Ss = 7.716E-6 ft^{-1}



TWIN PINES - PZ55D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55D Bail_BR_SJS.aqt
Date: 06/03/19 Time: 14:45:42

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 117.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

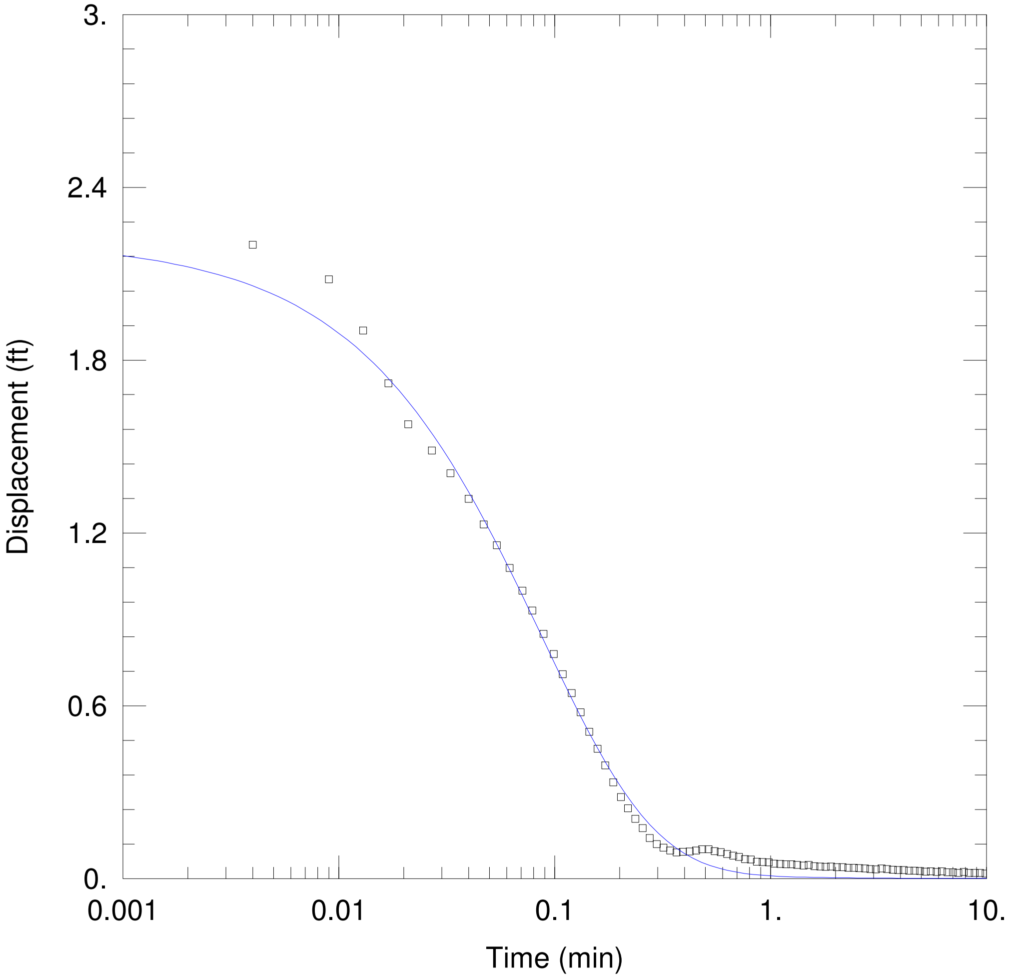
WELL DATA (PZ55D Bail)

Initial Displacement: 2.22 ft
Total Well Penetration Depth: 45.68 ft
Casing Radius: 0.083 ft
Static Water Column Height: 45.68 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 18.49 ft/day
y0 = 1.993 ft



TWIN PINES - PZ55D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55D Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 14:46:53

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 117.5 ft

WELL DATA (PZ55D Bail)

Initial Displacement: 2.22 ft
Total Well Penetration Depth: 45.68 ft
Casing Radius: 0.083 ft

Static Water Column Height: 45.68 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

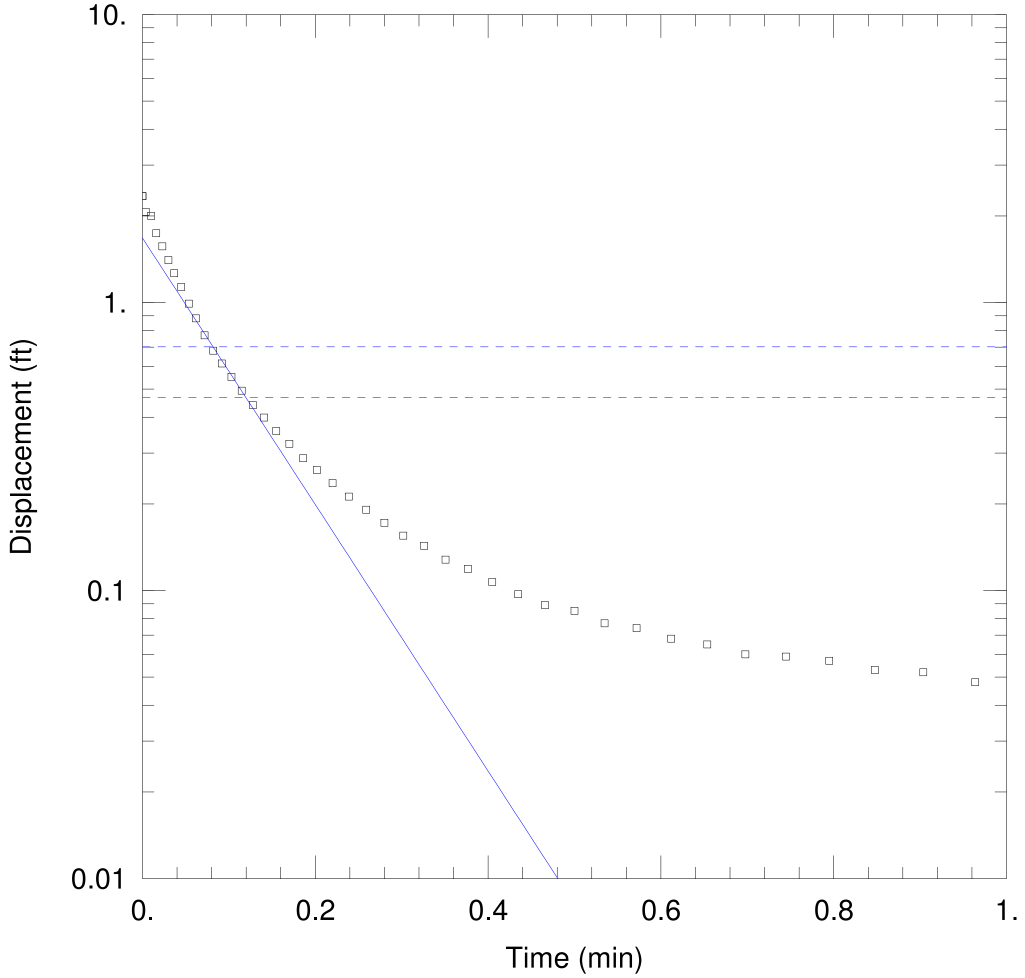
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 20.27 ft/day
Kz/Kr = 0.1

Ss = 1.162E-5 ft^{-1}



TWIN PINES - PZ55D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55D Slug_BR_SJS.aqt
Date: 06/03/19 Time: 15:22:28

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 117.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

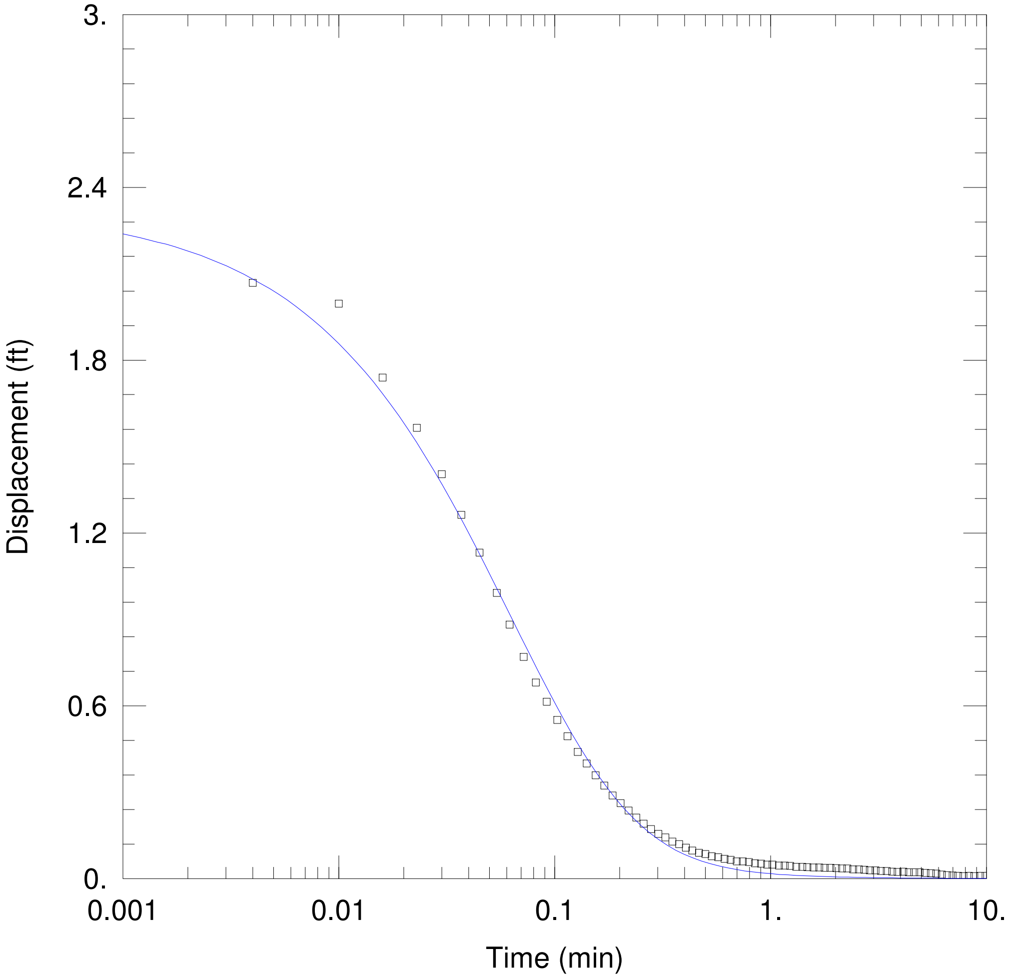
WELL DATA (PZ55D Slug)

Initial Displacement: 2.34 ft
Total Well Penetration Depth: 45.67 ft
Casing Radius: 0.083 ft
Static Water Column Height: 45.67 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 20.97 ft/day
y0 = 1.675 ft



TWIN PINES - PZ55D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55D Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 15:22:47

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 117.5 ft

WELL DATA (PZ55D Slug)

Initial Displacement: 2.34 ft
Total Well Penetration Depth: 45.67 ft
Casing Radius: 0.083 ft

Static Water Column Height: 45.67 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

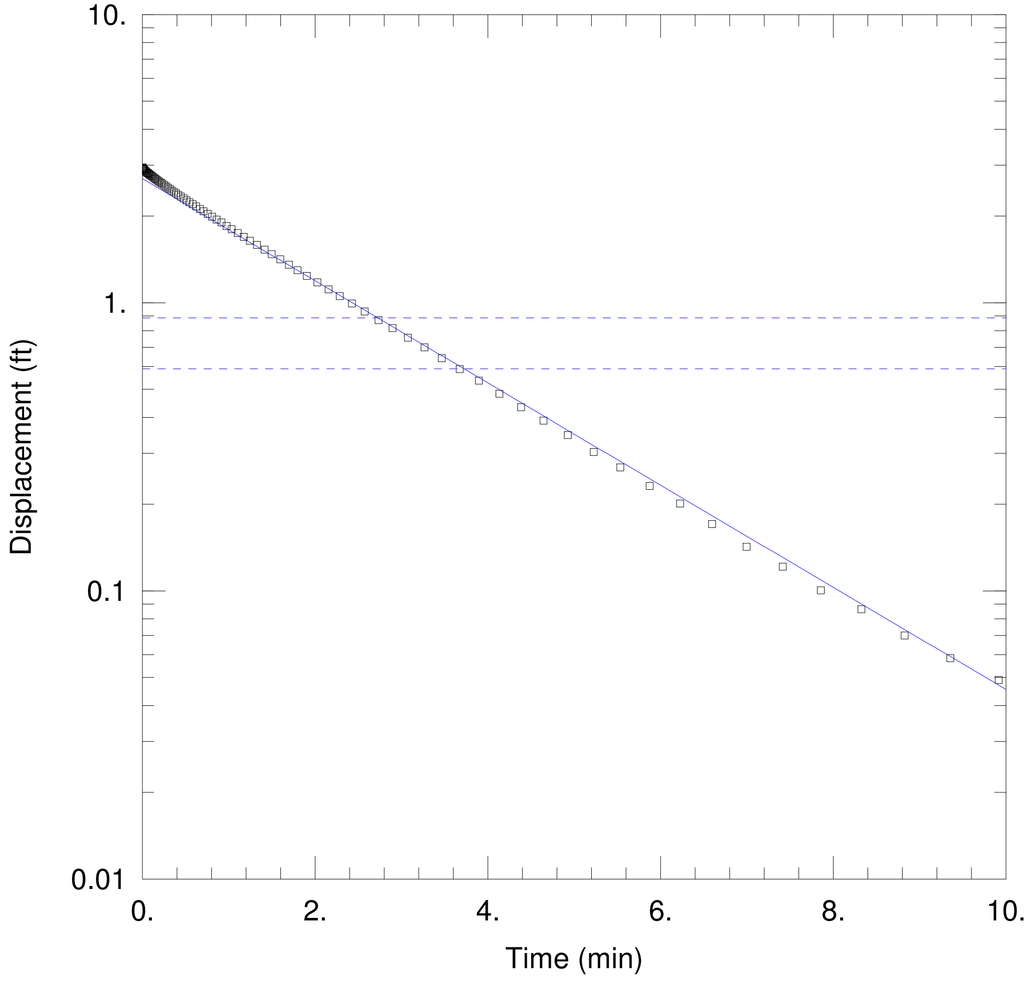
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 21.96 ft/day
Kz/Kr = 0.1

Ss = 6.225E-5 ft^{-1}



TWIN PINES - PZ55S BAIL TEST

Data Set: H:\...\PZ55S Bail_BR_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:25:20

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 119. ft
Anisotropy Ratio (Kz/Kr): 0.1

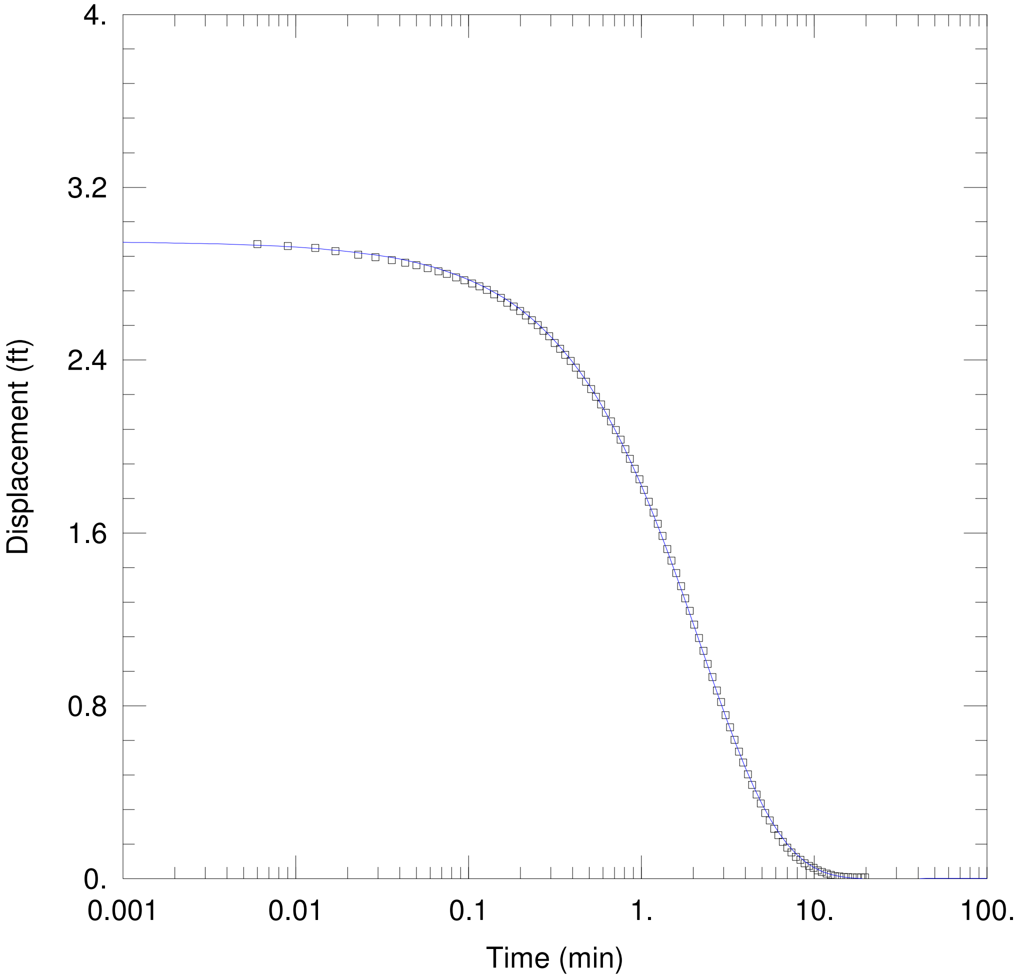
WELL DATA (PZ55S Bail)

Initial Displacement: 2.95 ft
Static Water Column Height: 17.85 ft
Total Well Penetration Depth: 17.85 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.7175 ft/day
y0 = 2.693 ft



TWIN PINES - PZ55S BAIL TEST

Data Set: H:\...\PZ55S Bail_KGS_SJS_revdispl.aqt
Date: 06/03/19 Time: 14:25:40

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 119. ft

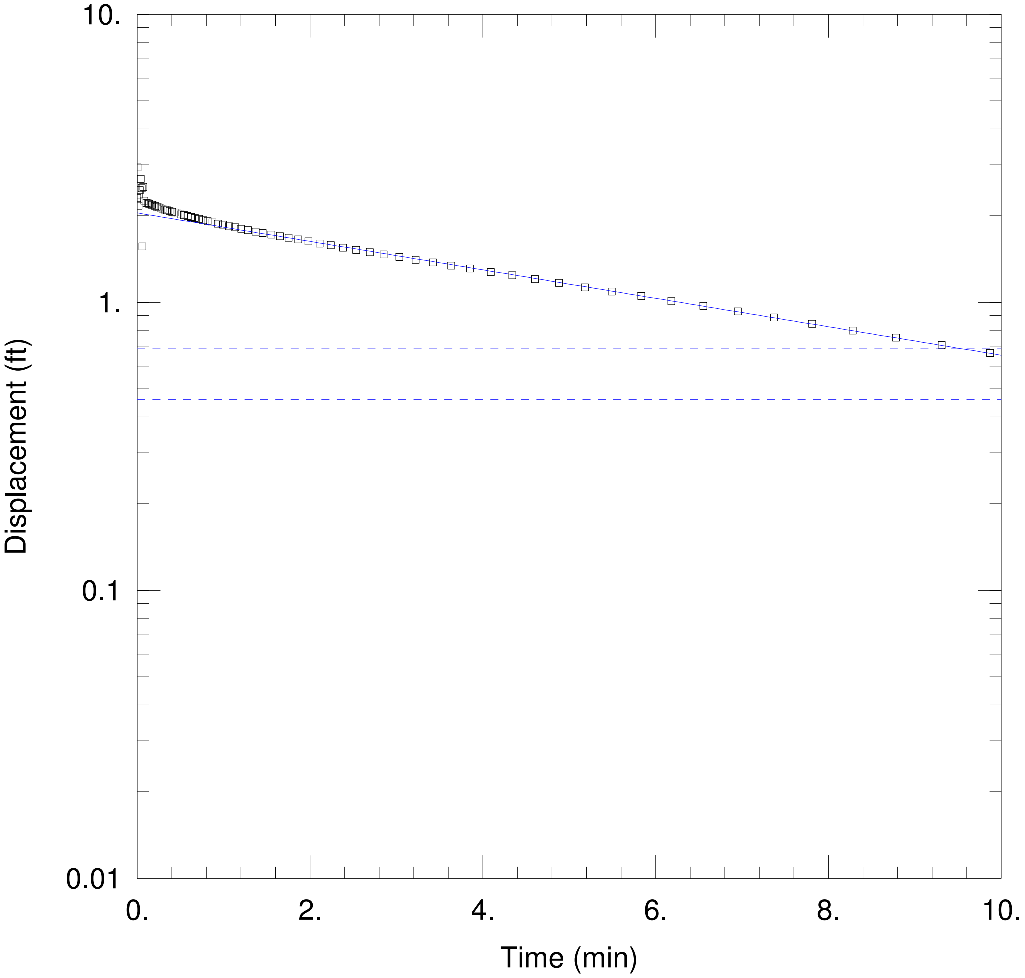
WELL DATA (PZ55S Bail)

Initial Displacement: 2.95 ft
Total Well Penetration Depth: 17.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.85 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.9459 ft/day
Kz/Kr = 0.1
Ss = 1.398E-6 ft^{-1}



TWIN PINES - PZ55S SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55S Slug_BR_SJS.aqt
Date: 06/10/19 Time: 12:31:37

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 119. ft
Anisotropy Ratio (Kz/Kr): 0.1

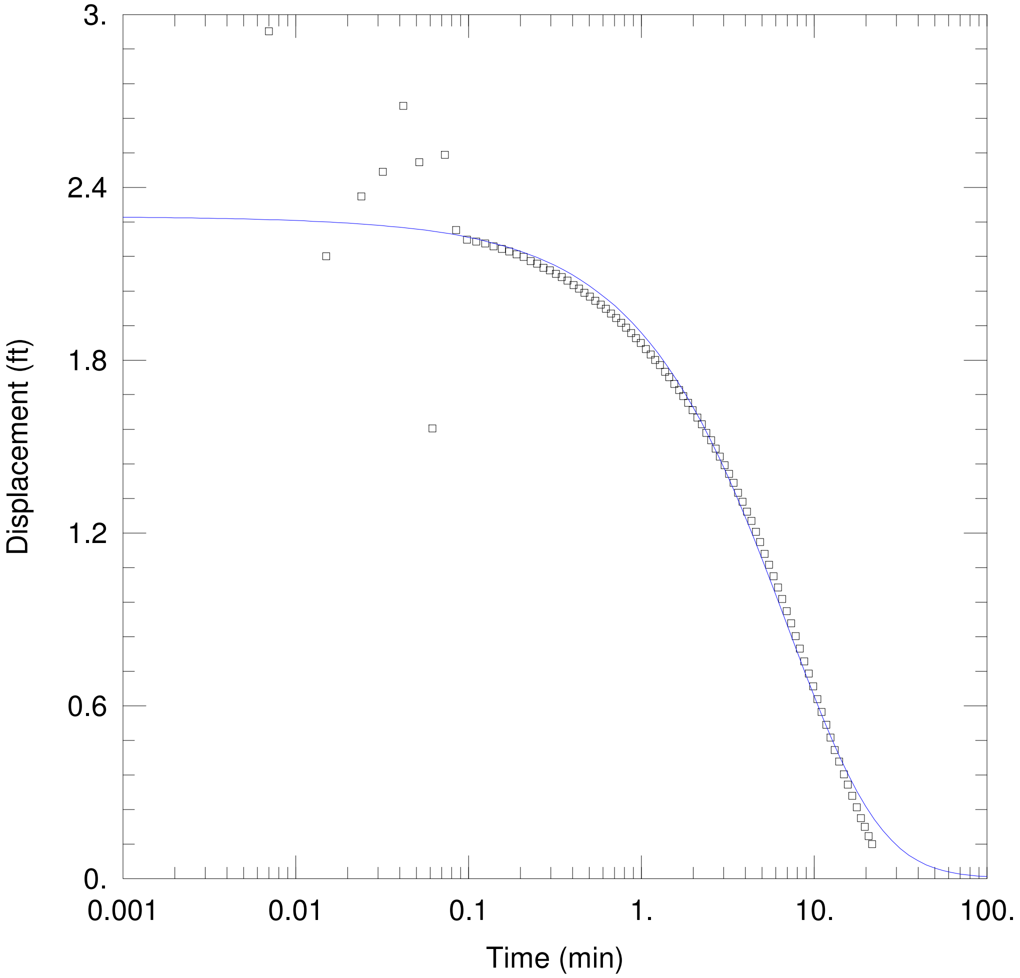
WELL DATA (PZ55S Slug)

Initial Displacement: 2.3 ft
Total Well Penetration Depth: 17.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.85 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.1999 ft/day
y0 = 2.043 ft



TWIN PINES - PZ55S SLUG TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ55S Slug_KGS_SJS.aqt
Date: 06/10/19 Time: 12:32:34

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ55S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 119. ft

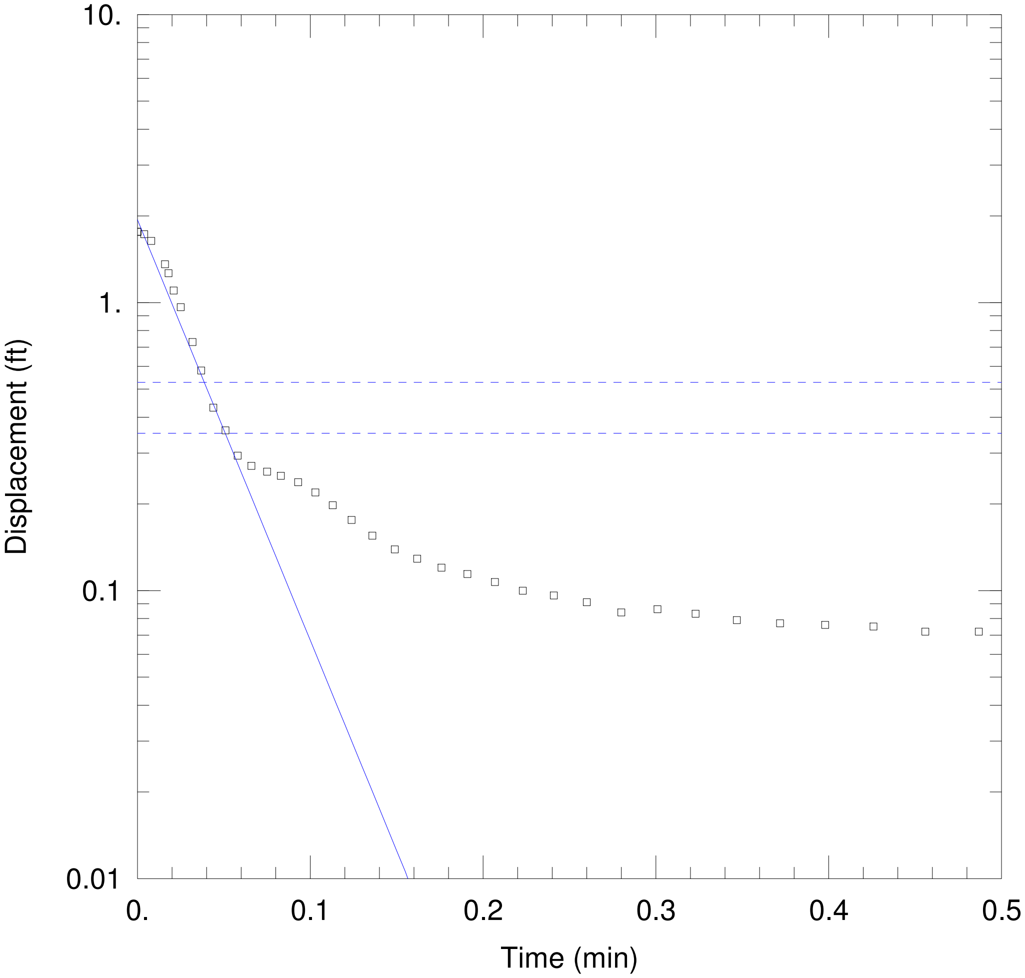
WELL DATA (PZ55S Slug)

Initial Displacement: 2.3 ft
Total Well Penetration Depth: 17.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.85 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.2404 ft/day
Kz/Kr = 0.1
Ss = 1.633E-5 ft^{-1}



TWIN PINES - PZ57D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57D Bail_BR_SJS.aqt
Date: 06/10/19 Time: 12:37:39

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 104. ft
Anisotropy Ratio (Kz/Kr): 0.1

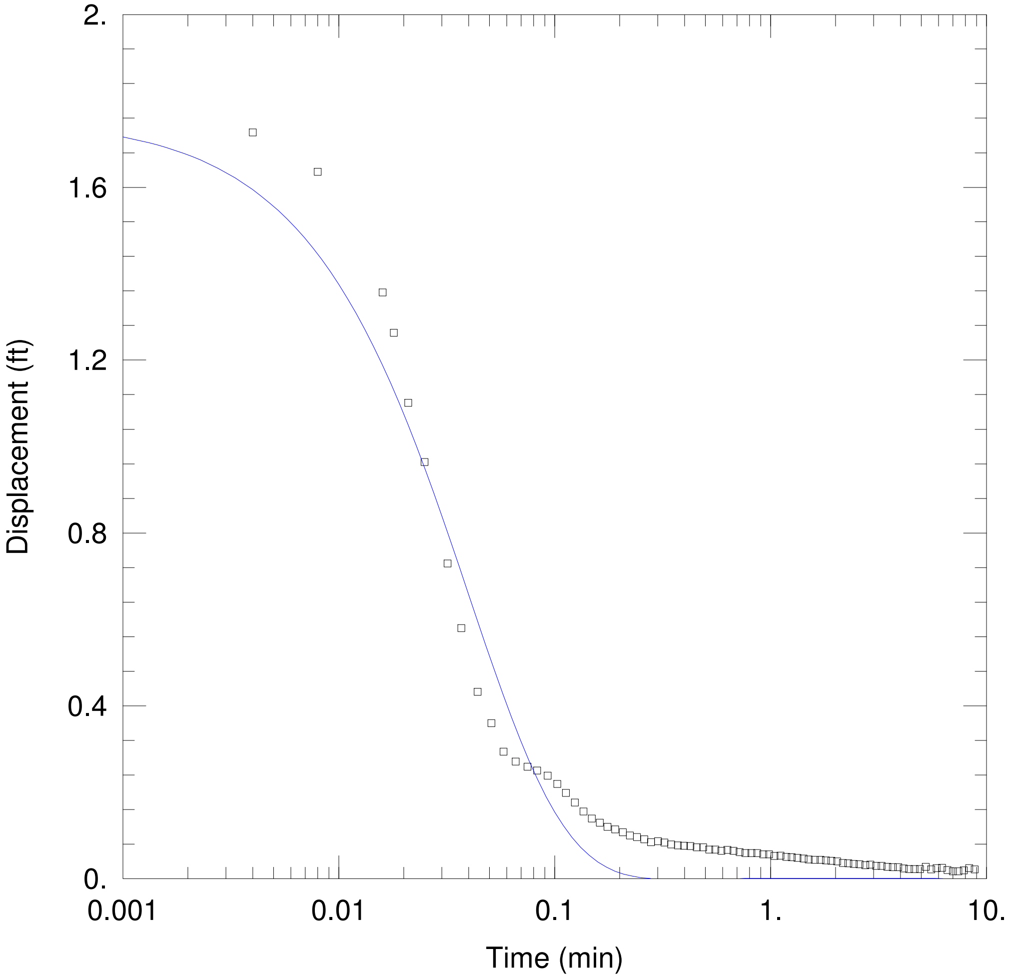
WELL DATA (PZ57D Bail)

Initial Displacement: 1.76 ft
Static Water Column Height: 43.19 ft
Total Well Penetration Depth: 43.19 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 65.77 ft/day
y0 = 1.937 ft



TWIN PINES - PZ57D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57D Bail_KGS_SJS.aqt
Date: 06/10/19 Time: 12:40:24

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 104. ft

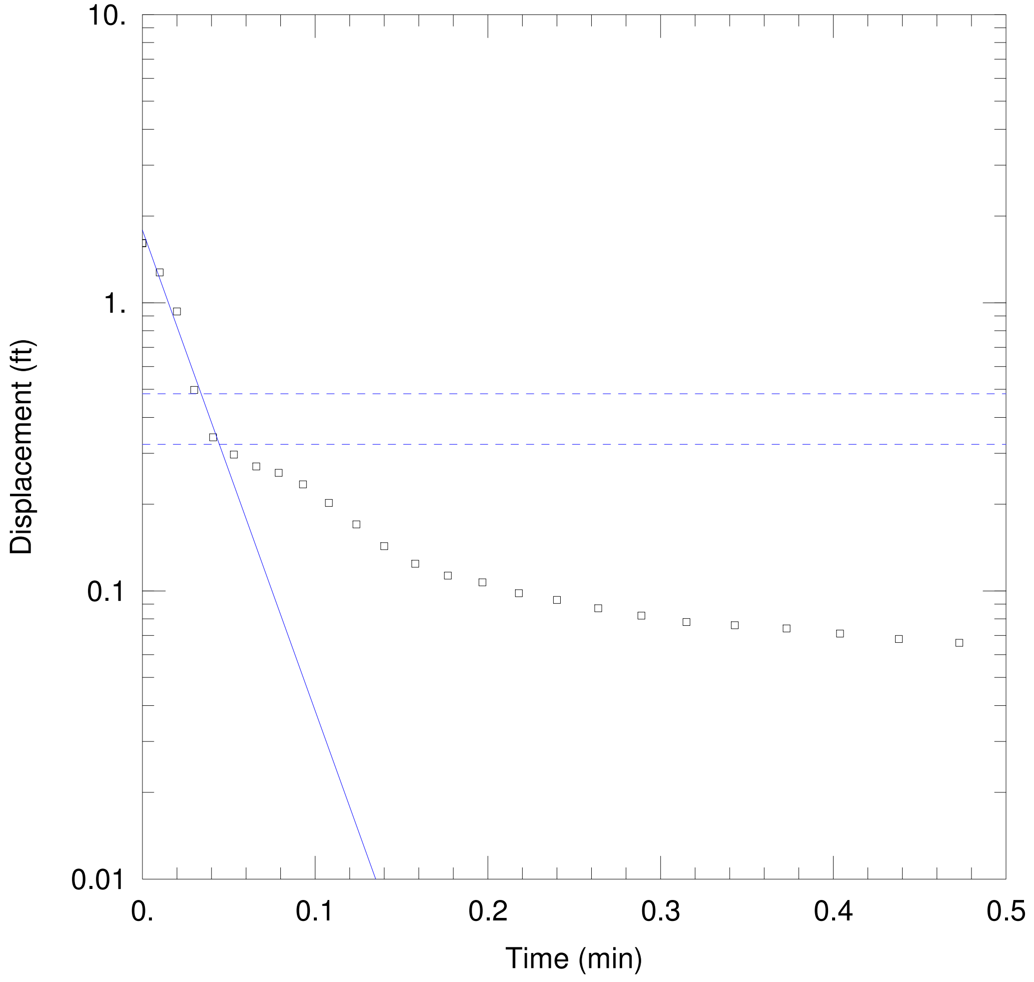
WELL DATA (PZ57D Bail)

Initial Displacement: 1.76 ft
Total Well Penetration Depth: 43.19 ft
Casing Radius: 0.083 ft
Static Water Column Height: 43.19 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 54.71 ft/day
Kz/Kr = 0.1
Ss = 3.79E-20 ft^{-1}



TWIN PINES - PZ57D SLUG EST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57D Slug_BR_SJS.aqt
Date: 06/10/19 Time: 12:42:58

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 104. ft
Anisotropy Ratio (Kz/Kr): 0.1

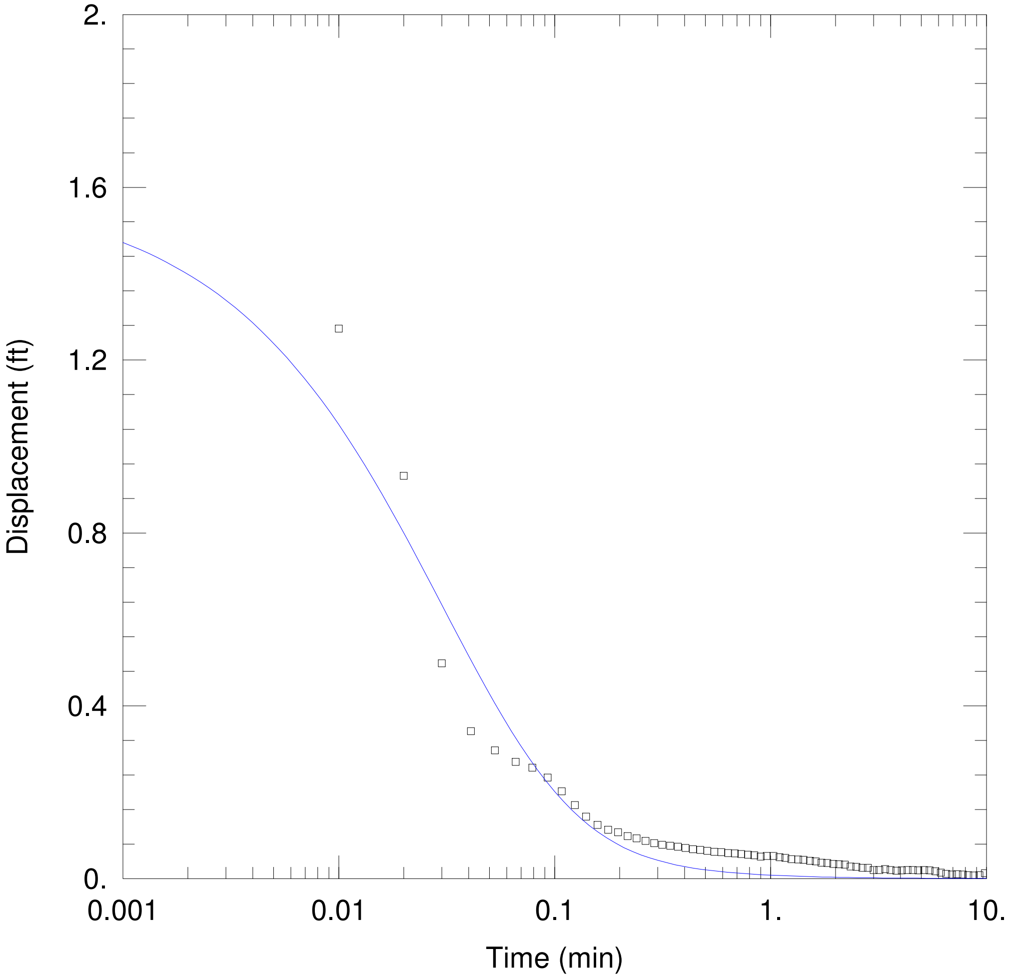
WELL DATA (PZ57D Slug)

Initial Displacement: 1.61 ft
Static Water Column Height: 43.18 ft
Total Well Penetration Depth: 43.18 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 75.09 ft/day
y0 = 1.783 ft



TWIN PINES - PZ57D SLUG EST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57D Slug_KGS_SJS.aqt
Date: 06/10/19 Time: 12:38:38

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 104. ft

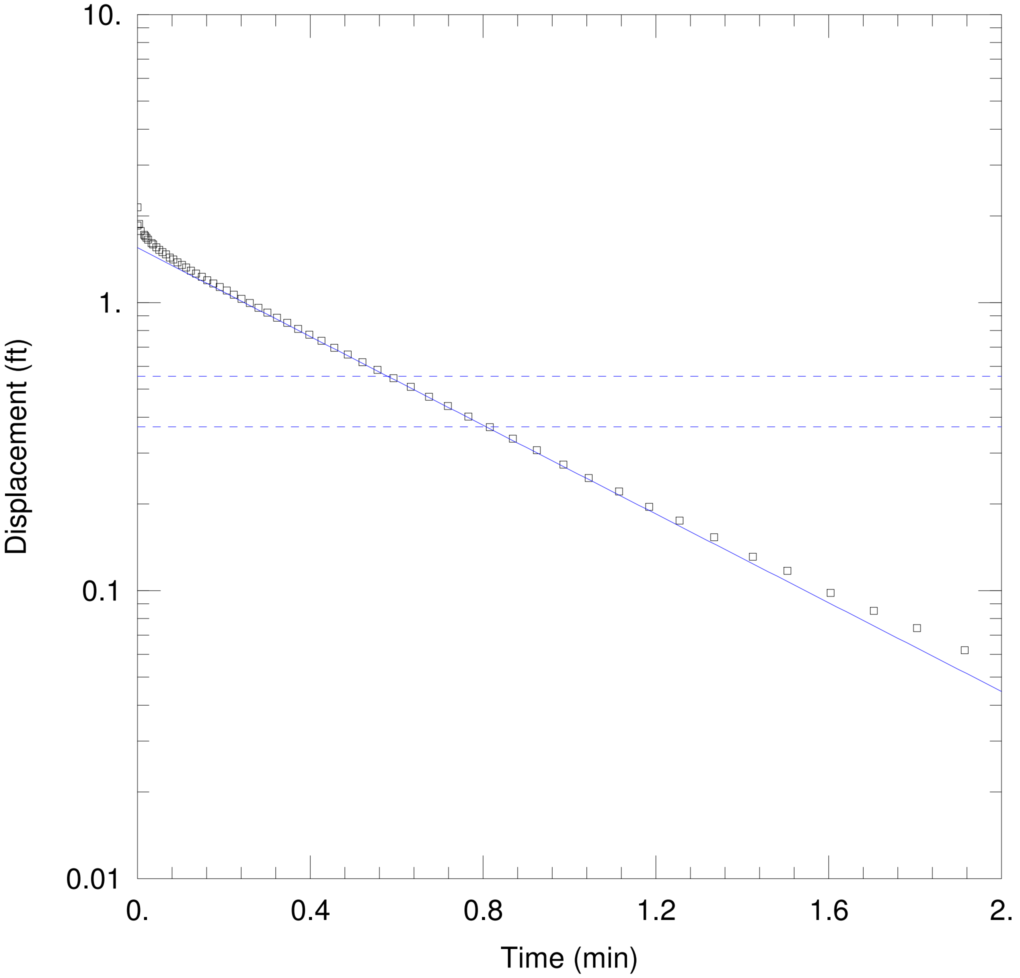
WELL DATA (PZ57D Slug)

Initial Displacement: 1.61 ft
Total Well Penetration Depth: 43.18 ft
Casing Radius: 0.083 ft
Static Water Column Height: 43.18 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 35.94 ft/day
Kz/Kr = 0.1
Ss = 0.0002028 ft^{-1}



TWIN PINES - PZ57S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57S Bail_BR_SJS.aqt
Date: 06/10/19 Time: 12:45:19

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 108. ft
Anisotropy Ratio (Kz/Kr): 0.1

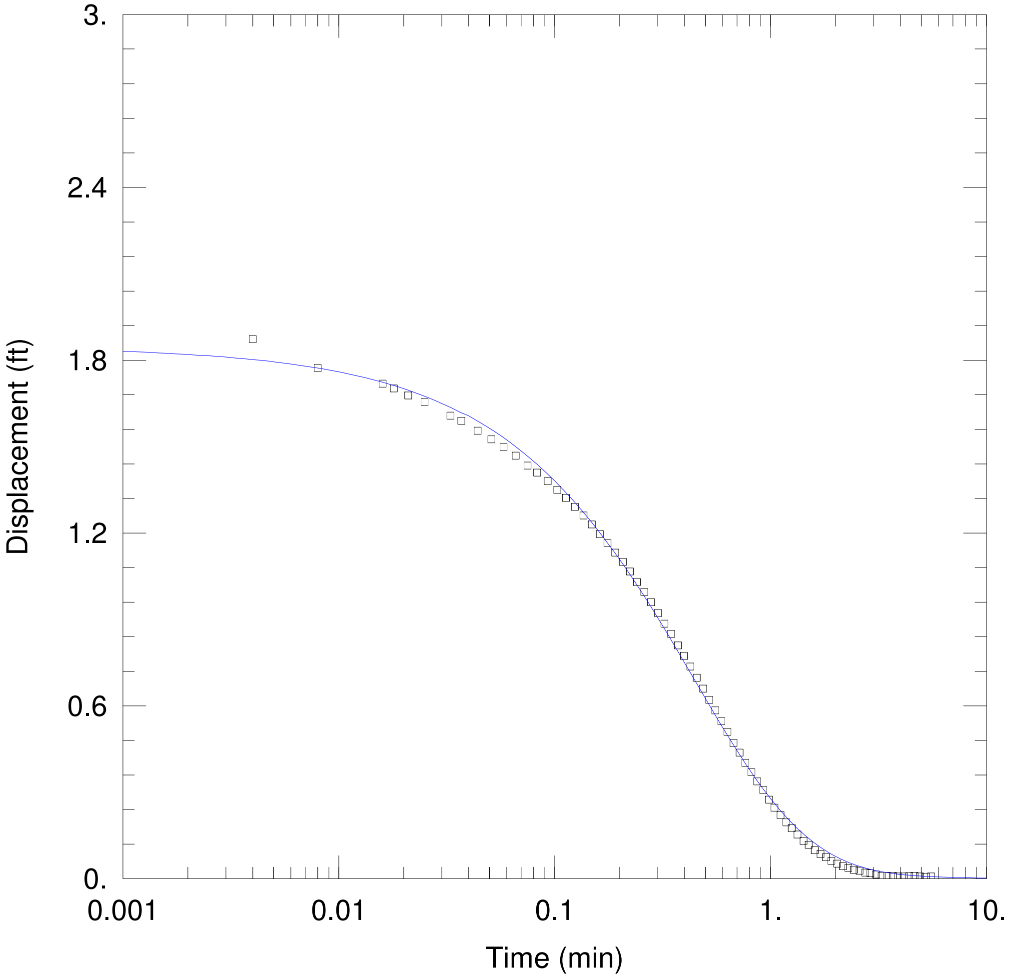
WELL DATA (PZ57S Bail)

Initial Displacement: 1.85 ft
Total Well Penetration Depth: 11.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.85 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.38 ft/day
y0 = 1.549 ft



TWIN PINES - PZ57S BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57S Bail_KGS_SJS.aqt
Date: 06/10/19 Time: 12:46:11

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 108. ft

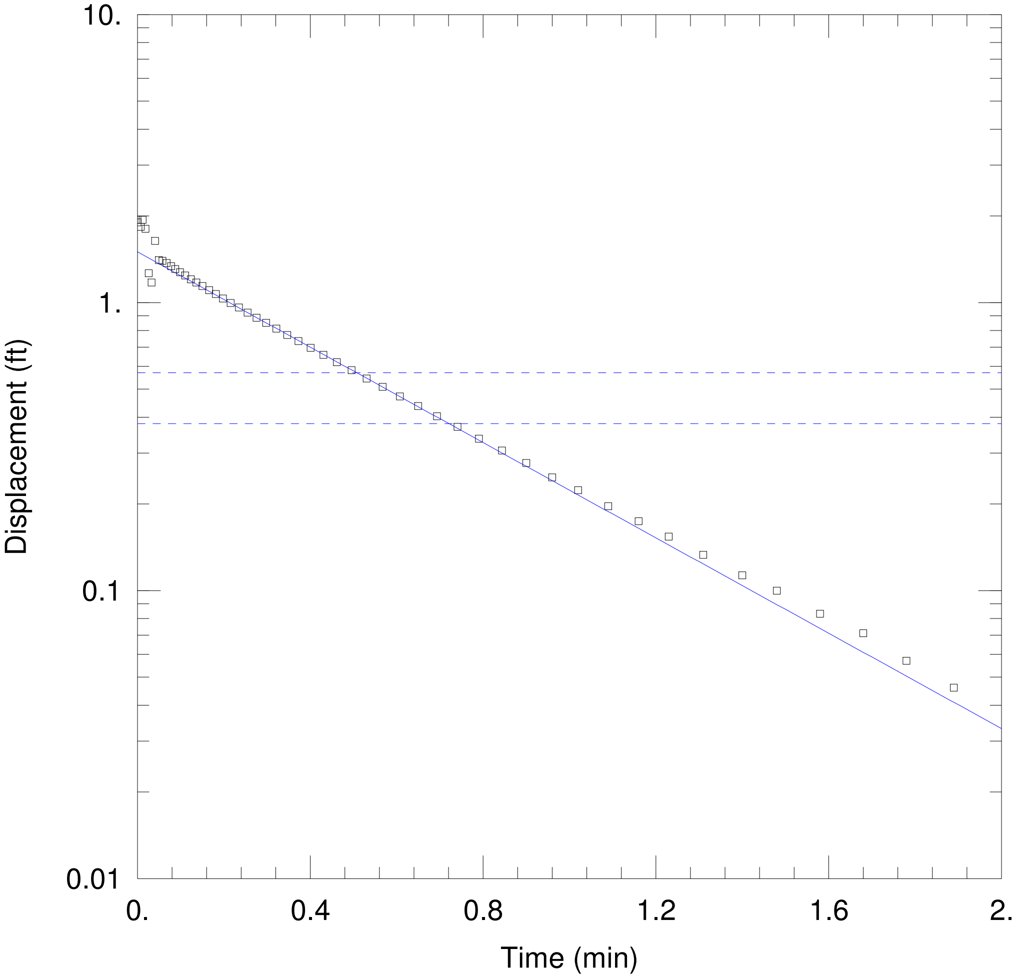
WELL DATA (PZ57S Bail)

Initial Displacement: 1.85 ft
Total Well Penetration Depth: 11.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.85 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 6.774 ft/day
Kz/Kr = 0.1
Ss = 6.372E-5 ft^{-1}



TWIN PINES - PZ57S SLUG EST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57S Slug_BR_SJS.aqt
Date: 06/10/19 Time: 12:47:18

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 108. ft
Anisotropy Ratio (Kz/Kr): 0.1

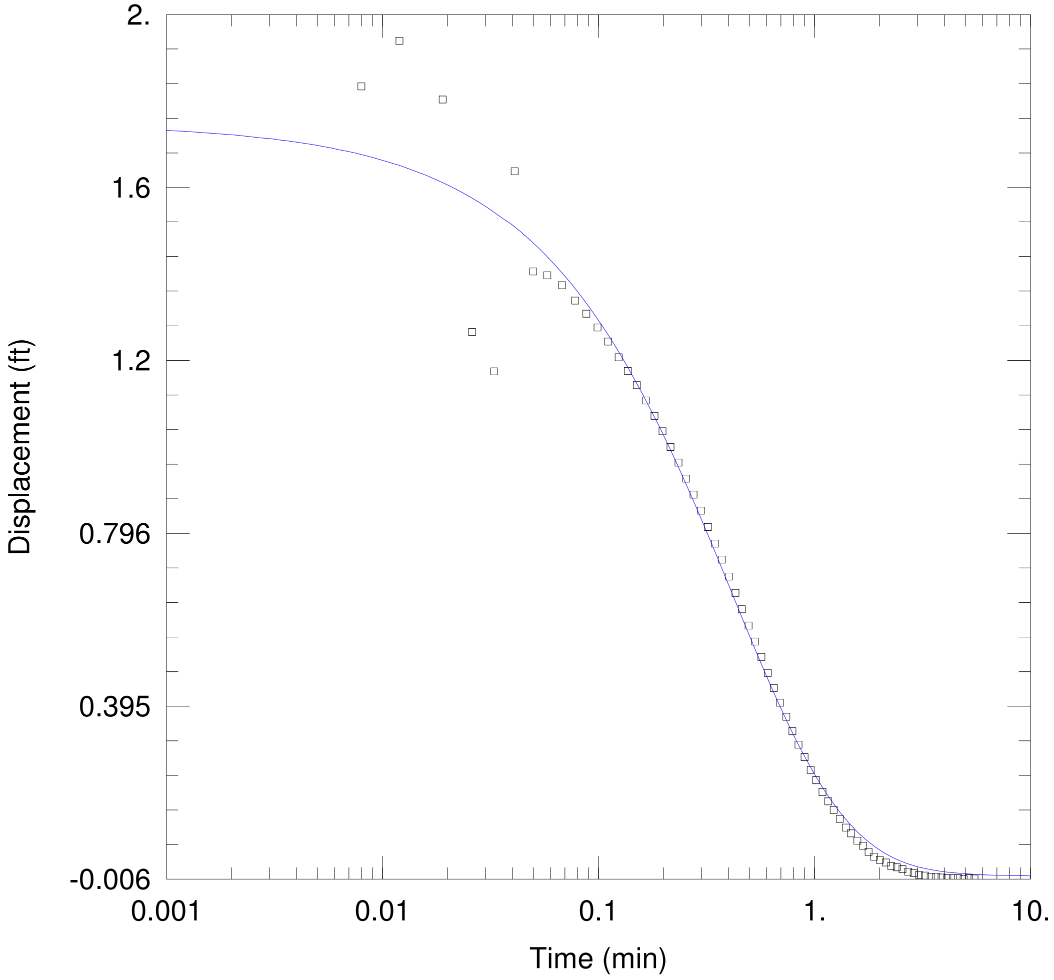
WELL DATA (PZ57S Slug)

Initial Displacement: 1.9 ft
Static Water Column Height: 11.85 ft
Total Well Penetration Depth: 11.85 ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.782 ft/day
y0 = 1.5 ft



TWIN PINES - PZ57S SLUG EST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ57S Slug_KGS_SJS.aqt
Date: 06/10/19 Time: 12:48:11

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 108. ft

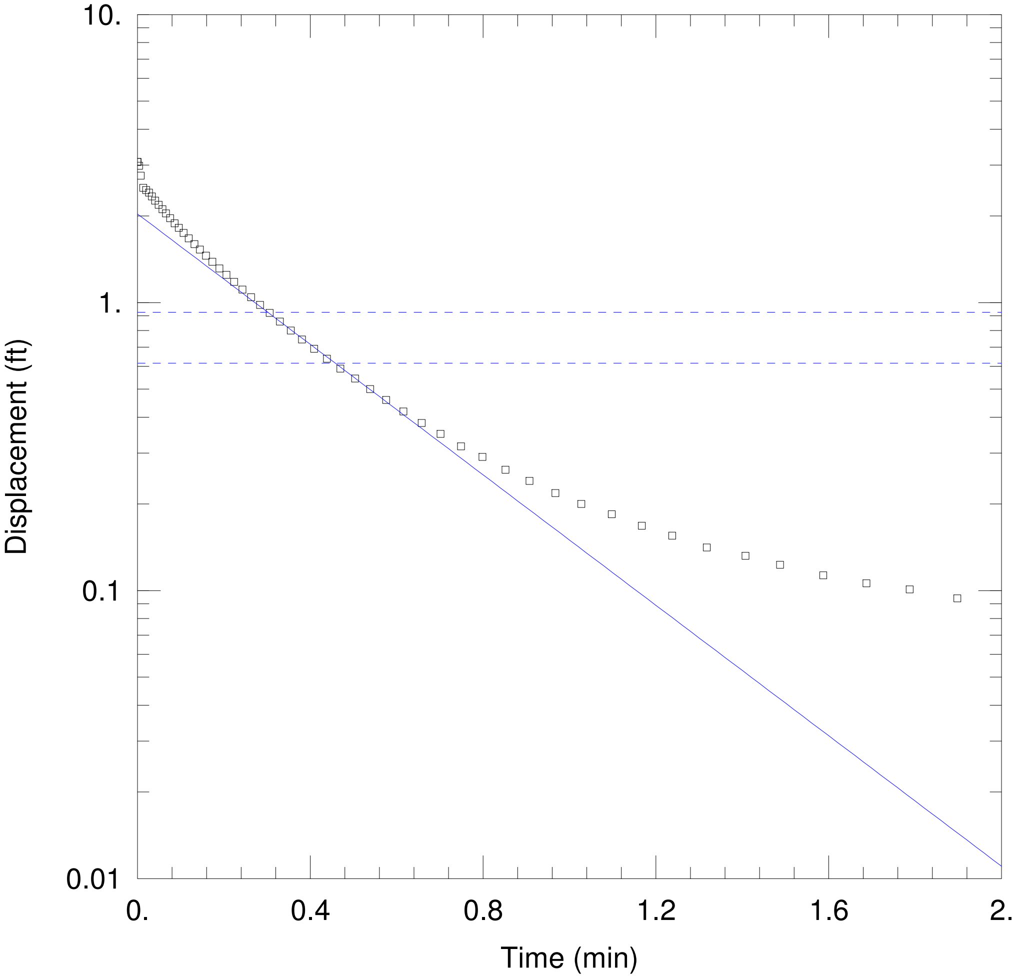
WELL DATA (PZ57S Slug)

Initial Displacement: 1.75 ft
Total Well Penetration Depth: 11.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.85 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 7.262 ft/day
Kz/Kr = 0.1
Ss = 5.753E-5 ft^{-1}



TWIN PINES - PZ58D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58D Bail_BR_SJS.aqt
Date: 06/03/19 Time: 15:00:09

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 91.99 ft
Anisotropy Ratio (Kz/Kr): 0.1

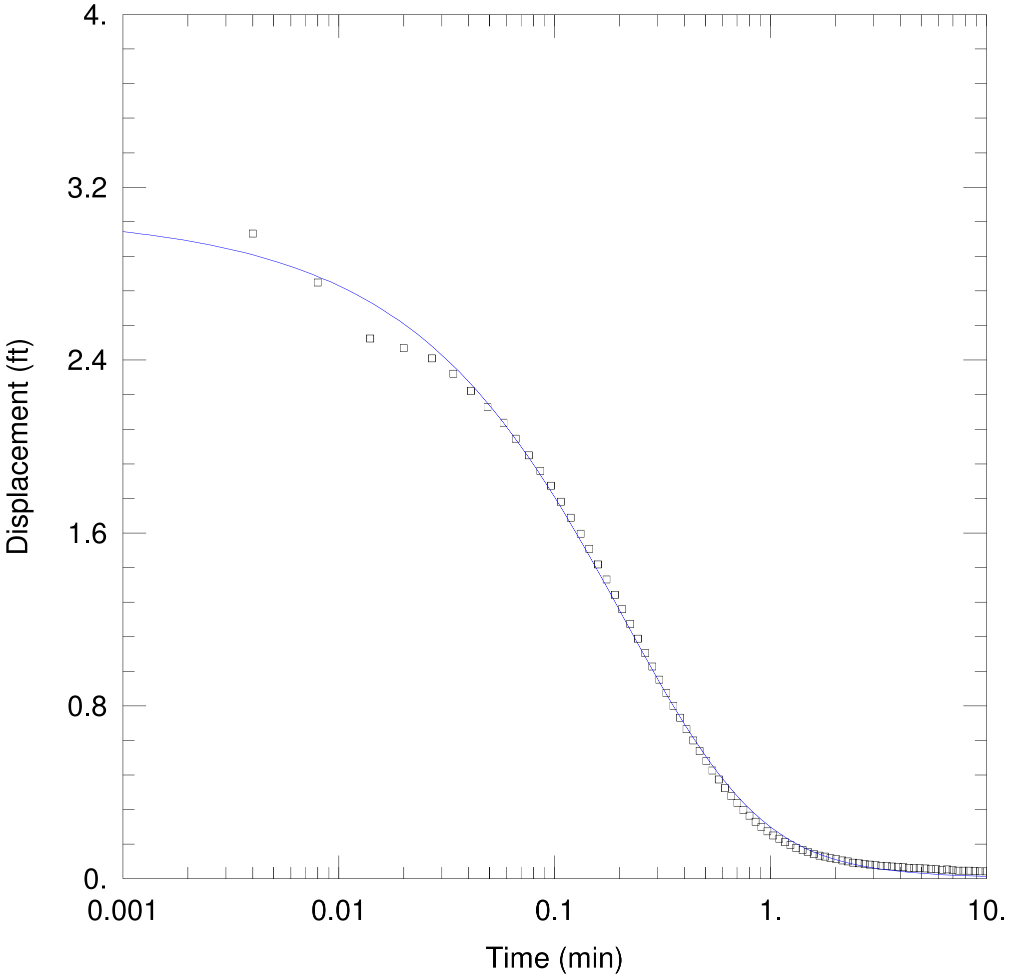
WELL DATA (PZ58D Bail)

Initial Displacement: 3.08 ft
Total Well Penetration Depth: 42.99 ft
Casing Radius: 0.083 ft
Static Water Column Height: 42.99 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.098 ft/day
y0 = 2.031 ft



TWIN PINES - PZ58D BAIL TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58D Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 15:00:37

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 91.99 ft

WELL DATA (PZ58D Bail)

Initial Displacement: 3.08 ft
Total Well Penetration Depth: 42.99 ft
Casing Radius: 0.083 ft

Static Water Column Height: 42.99 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

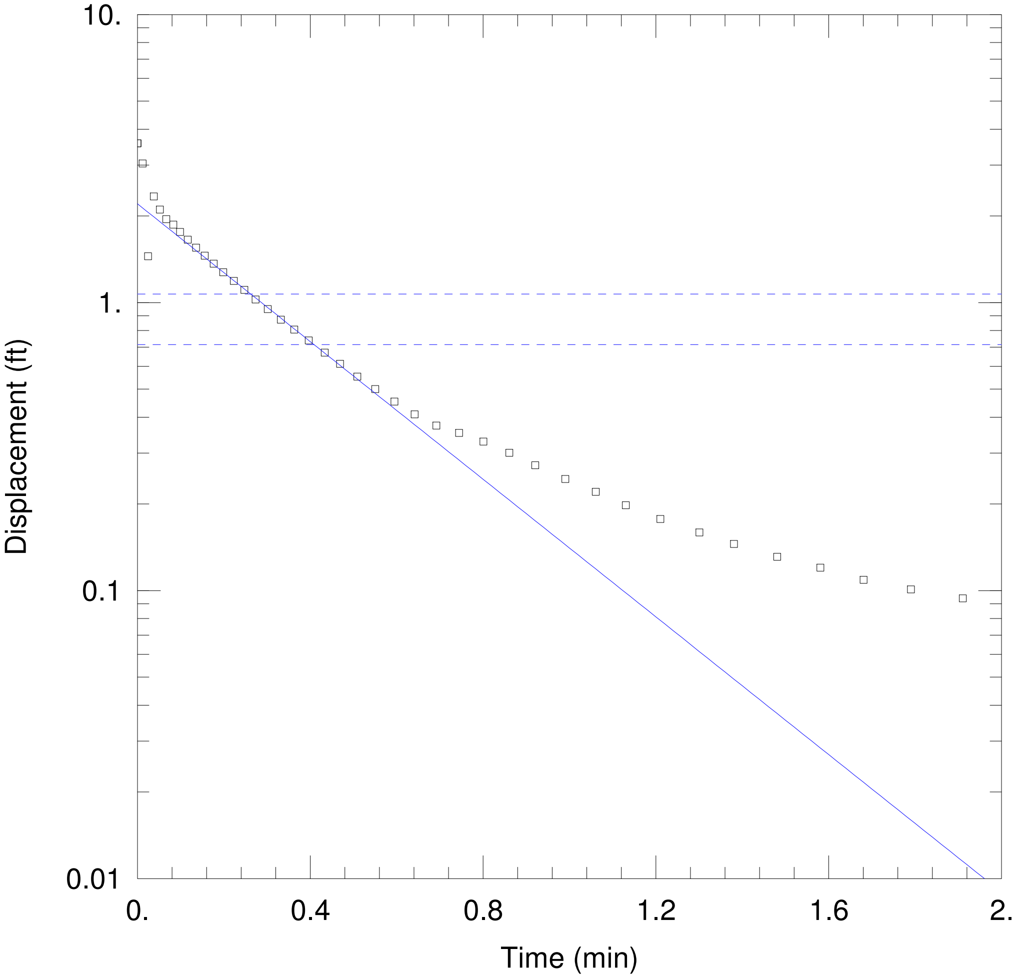
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 5.098 ft/day
Kz/Kr = 0.1

Ss = 0.0002214 ft^{-1}



TWIN PINES - PZ58D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58D Slug_BR_SJS.aqt
Date: 06/03/19 Time: 15:24:56

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 91.99 ft
Anisotropy Ratio (Kz/Kr): 0.1

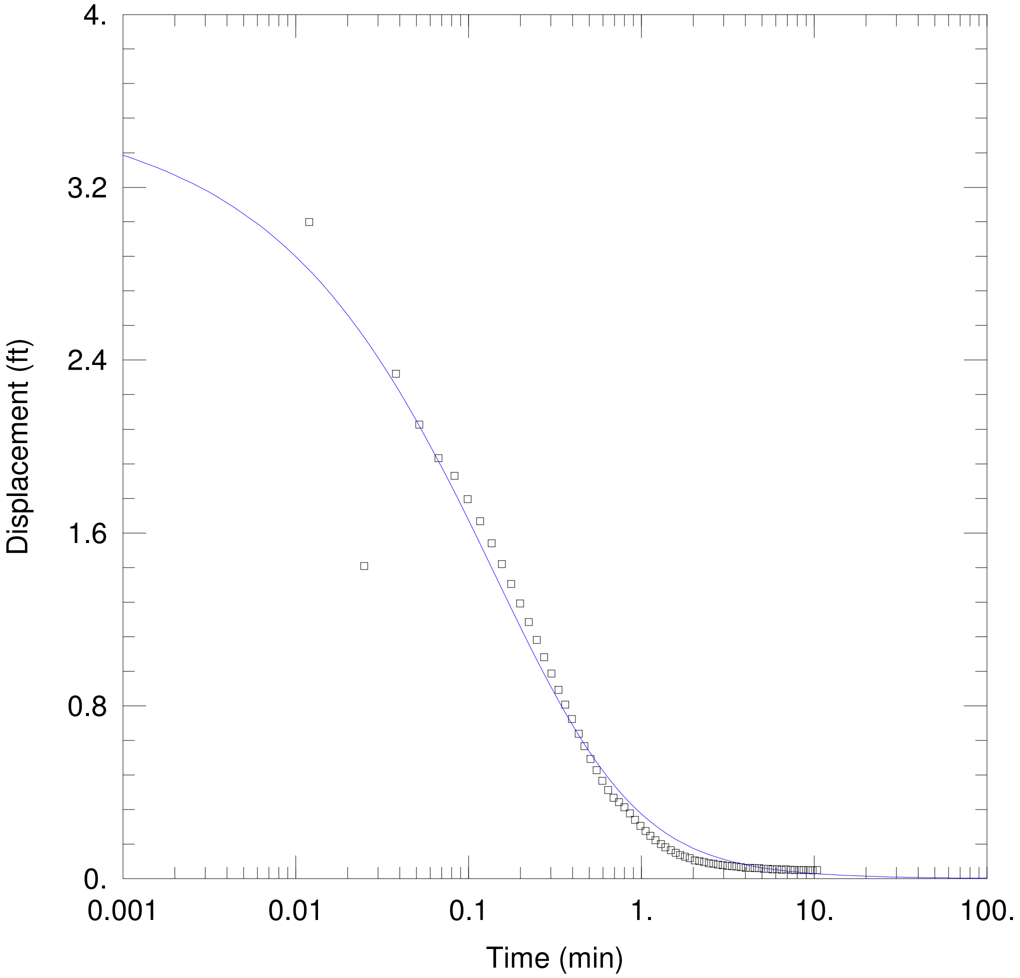
WELL DATA (PZ58D Slug)

Initial Displacement: 3.57 ft
Total Well Penetration Depth: 42.95 ft
Casing Radius: 0.083 ft
Static Water Column Height: 42.95 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.379 ft/day
y0 = 2.2 ft



TWIN PINES - PZ58D SLUGTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58D Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 15:25:18

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58D Slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 91.99 ft

WELL DATA (PZ58D Slug)

Initial Displacement: 3.57 ft
Total Well Penetration Depth: 42.95 ft
Casing Radius: 0.083 ft

Static Water Column Height: 42.95 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

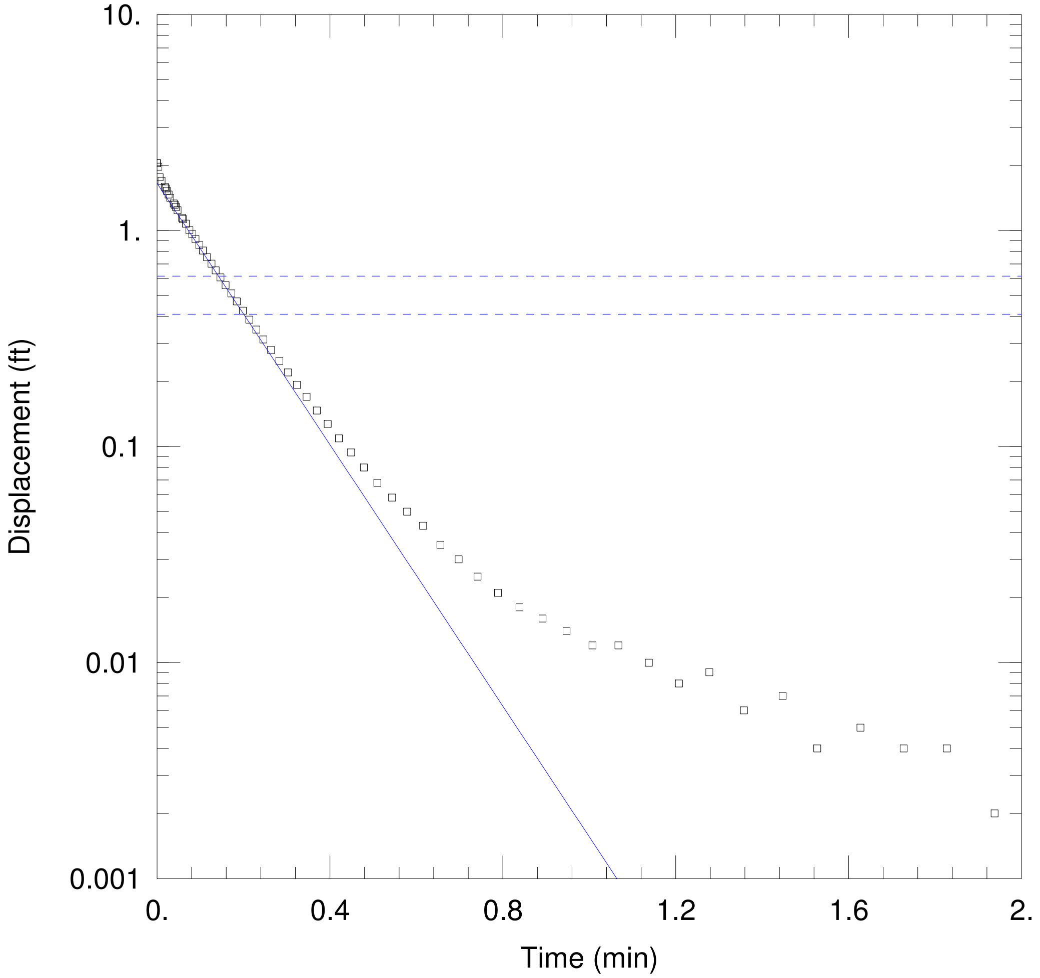
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 3.554 ft/day
Kz/Kr = 0.1

Ss = 0.002183 ft^{-1}



TWIN PINES - PZ58S BAILTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58S Bail_BR_SJS.aqt
Date: 06/03/19 Time: 15:26:13

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 95.85 ft
Anisotropy Ratio (Kz/Kr): 0.1

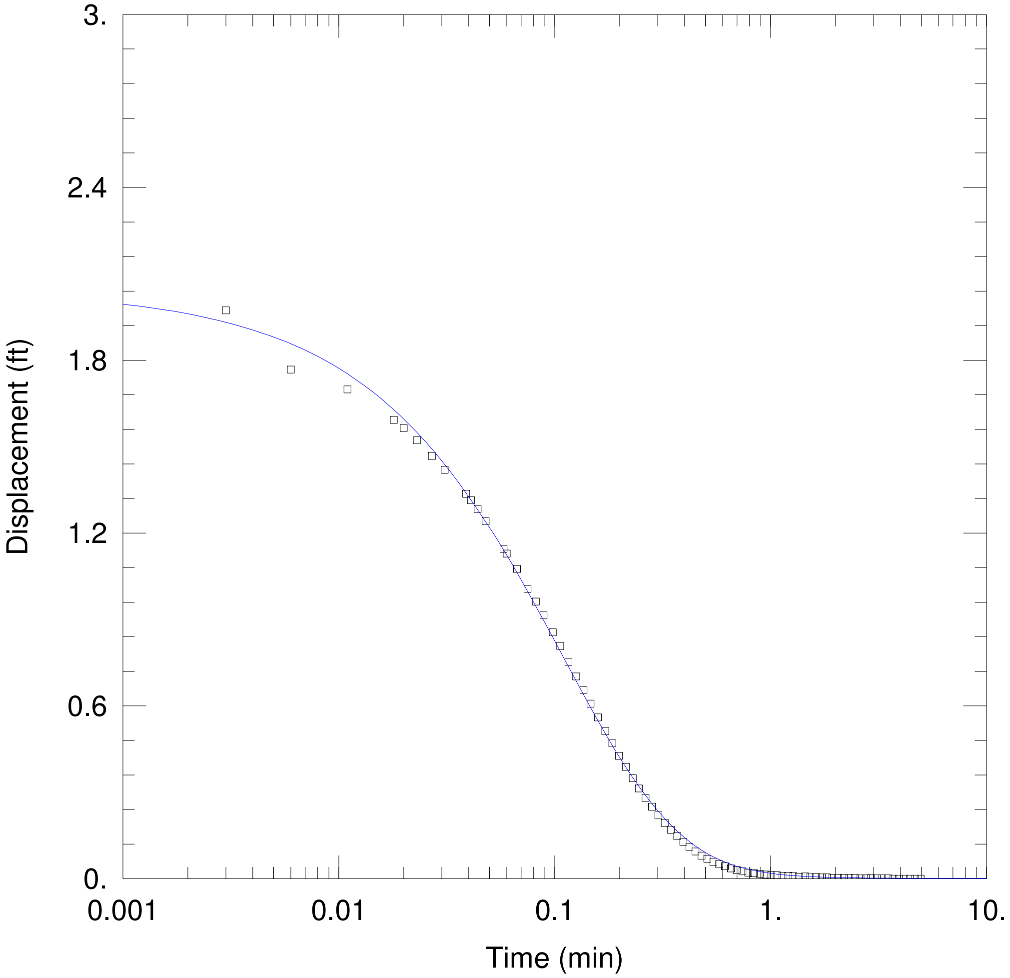
WELL DATA (PZ58S Bail)

Initial Displacement: 2.05 ft
Static Water Column Height: 11.85 ft
Total Well Penetration Depth: 11.85 ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 21.14 ft/day
y0 = 1.654 ft



TWIN PINES - PZ58S BAILTEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58S Bail_KGS_SJS.aqt
Date: 06/03/19 Time: 15:27:13

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S bail
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 95.85 ft

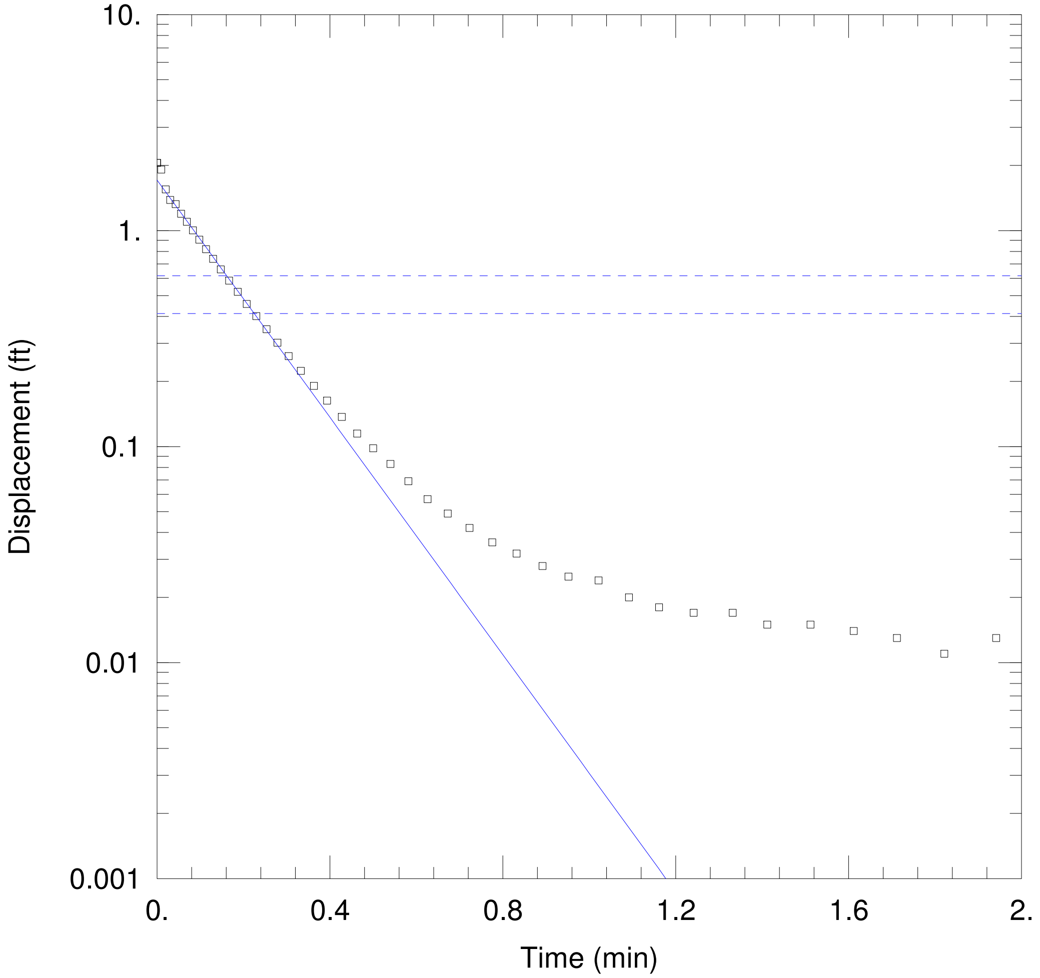
WELL DATA (PZ58S Bail)

Initial Displacement: 2.05 ft
Total Well Penetration Depth: 11.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.85 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 26.61 ft/day
Kz/Kr = 0.1
Ss = 7.872E-5 ft^{-1}



TWIN PINES - PZ58S SLUG TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58S Slug_BR_SJS.aqt
Date: 06/03/19 Time: 15:01:39

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S slug
Test Date: 5-16-19

AQUIFER DATA

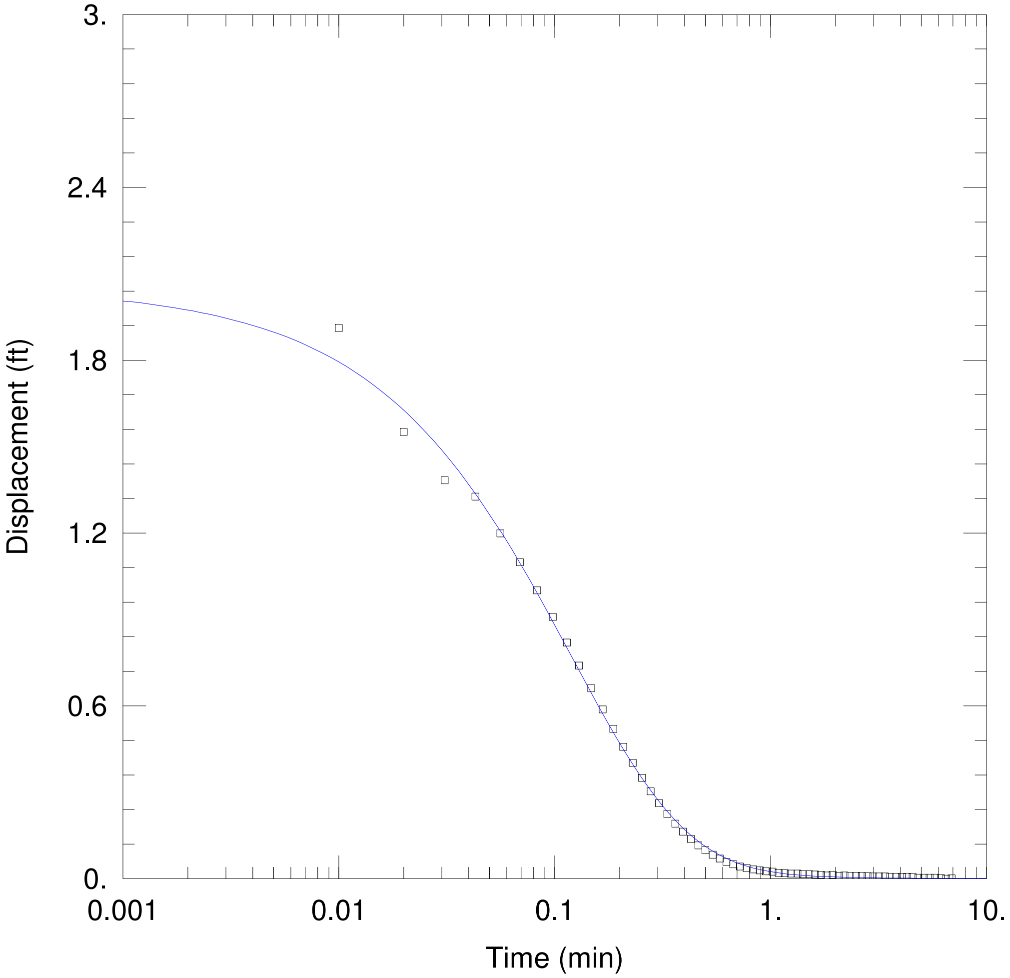
Saturated Thickness: 95.85 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (PZ58S Slug)

Initial Displacement: 2.06 ft
Static Water Column Height: 11.85 ft
Total Well Penetration Depth: 11.85 ft
Screen Length: 5. ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 19.18 ft/day
y0 = 1.711 ft



TWIN PINES - PZ58S SLUG TEST

Data Set: H:\2018033.10 TTL Twin Pines Add Testing\addl_slug\SJS_aqtesolve\PZ58S Slug_KGS_SJS.aqt
Date: 06/03/19 Time: 15:26:39

PROJECT INFORMATION

Company: TTL, Inc.
Client: Twin Pines LLC
Project: 000180200804.00
Location: St. George, GA
Test Well: PZ58S slug
Test Date: 5-16-19

AQUIFER DATA

Saturated Thickness: 95.85 ft

WELL DATA (PZ58S Slug)

Initial Displacement: 2.06 ft
Total Well Penetration Depth: 11.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.85 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 24.15 ft/day
Kz/Kr = 0.1
Ss = 8.67E-5 ft^{-1}