Aquifer-Test Report for Well TW-8 (WW- 8)
January 10 – 11, 1963 Test
Interval Tested 1,250 – 1,780 feet

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INTRODUCTION

Numerous aquifer tests have been conducted in and around the Nevada Test Site. Many of these tests have been completed in a fractured rock medium. Methods used to analyze these aquifer tests have included the Theis and Cooper-Jacob solutions. Although both methods are used to estimate aquifer characteristics in fracture media, the results may be qualified because both methods were developed for porous rock media. Recently, GeoTrans Inc., working in cooperation with the U.S. Department of Energy (DOE), evaluated time/drawdown data collected in wells drilled for DOE in the Oasis Valley area (ER-EC wells, completed in fractured volcanic rock) using a fractured-rock, double-porosity model (Moench, 1984). Based on this evaluation, it was thought that analyzing aquifer-test results from these wells with a dual-porosity solution would yield a better transmissivity estimate in these wells. Subsequently, individuals from GeoTrans Inc. identified approximately 62 wells in the vicinity of the Nevada Test Site with aquifer test data that could potentially be reevaluated with a fractured-rock, double-porosity model. Transmissivity estimates from these aquifer tests will support ground-water flow models being developed for DOE.

The U.S. Geological Survey (USGS) proposed to DOE to work in cooperation with GeoTrans Inc. to review these aquifer tests for the availability of aquifer-test data that might be suitable for reevaluation. Well TW-8 (also know as water-well 8 (WW-8) in the literature) was one of the wells selected by the USGS for reevaluation. Transmissivity in well TW-8 has been estimated to be 50 ft^2/d by Belcher and Elliott, (2001, Appendix A: Hydraulic-Properties Database, worksheet OVU), from an aquifer test conducted on January 4 – 5, 1963 (intervals tested, perforated intervals 2,038 – 2070, and 2,137 – 2,170 and open-hole interval 2,936 – 5,490). This aquifer test data was not analyzed for this report, however, an aquifer test conducted January 10 – 11, 1963 (interval tested 1,250 – 1,780), was analyzed using the Cooper-Jacob solution (Cooper and Jacob, 1946) and Moench's dual-porosity spherical-shaped block and slab-shaped block solutions (Moench, 1984). Transmissivity estimates from each solution were compared.

TEST DESCRIPTION

Well TW-8 is located in Area 8 of the Nevada Test Site (fig. 1). On January 10, 1963, at 4:30 am (Pacific Standard Time, PST) the USGS began a single-well aquifer test on well TW-8 which lasted approximately 35 hours (pump off at 3:30 pm, PST, on January 11, 1963) (Winograd, I. J., 1965, p. 20 and 21). Average discharge during the test was 400 gallons per minute.

Winograd (1965, p. 22, footnote a/) reported that after the January 4 – 5, 1963, test (described as test of interval 2,031 – 5,490 feet by Winograd (1965, p. 17)) a cement bridge plug was set in the 11 ¾-inch casing at a depth of about 1,860 feet. Thereafter, the 11 ¾-inch casing was gun perforated -- 2 shots per foot – in the following intervals: 1,250 – 1,300, 1,450 – 1,500,

and 1,630 – 1,780 feet. These are the intervals tested during the January 10 – 11, 1963, test (described as test of interval 1,066 – 2,031, by Winograd (1965, p. 20)). Based on information presented in footnote a/, the saturated interval tested on January 10 – 11, 1963, is assumed to be 530 feet, the total distance from 1,250 to 1,780 feet.

In footnote b/ Winograd, (1965, p. 22) reported that TW-8 was pumped intermittently prior to the January 10 – 11, 1963, however, prior to the start of the January 10th test, the water level had recovered to within a few tenths of the static level prior to the test. No adjustments to the drawdown data due to barometric, tidal, or temperature effects were made.

On page 5, Winograd (1965) reported that

> *"All water-level measurements presented are presented from a specific measuring point. Measurements pertaining to well construction were corrected to land surface datum.*
>
> *Water levels were measured with a deep-well electrical line capable of detecting relative changes in water level as small as 0.02 foot. The static-level measurements have not been corrected to a steel tape secondary standard and should not be used for water-level contouring.*
>
> *A Reda oil-well submersible pump was used. A positive displacement check value was placed in the discharge line immediately above the pump. A second check valve was usually placed several hundred feet above the pump.*
>
> *Discharge measurements were made using Sparling water meters. In several tests the meter accuracy was checked with a calibrated 10,000 gallon tank."*

TEST SITE

Well TW-8 is located at 37 ° 09’ 56” N.; 116 ° 17’ 21” W., in Area 8 of the Nevada Test Site (fig. 1).

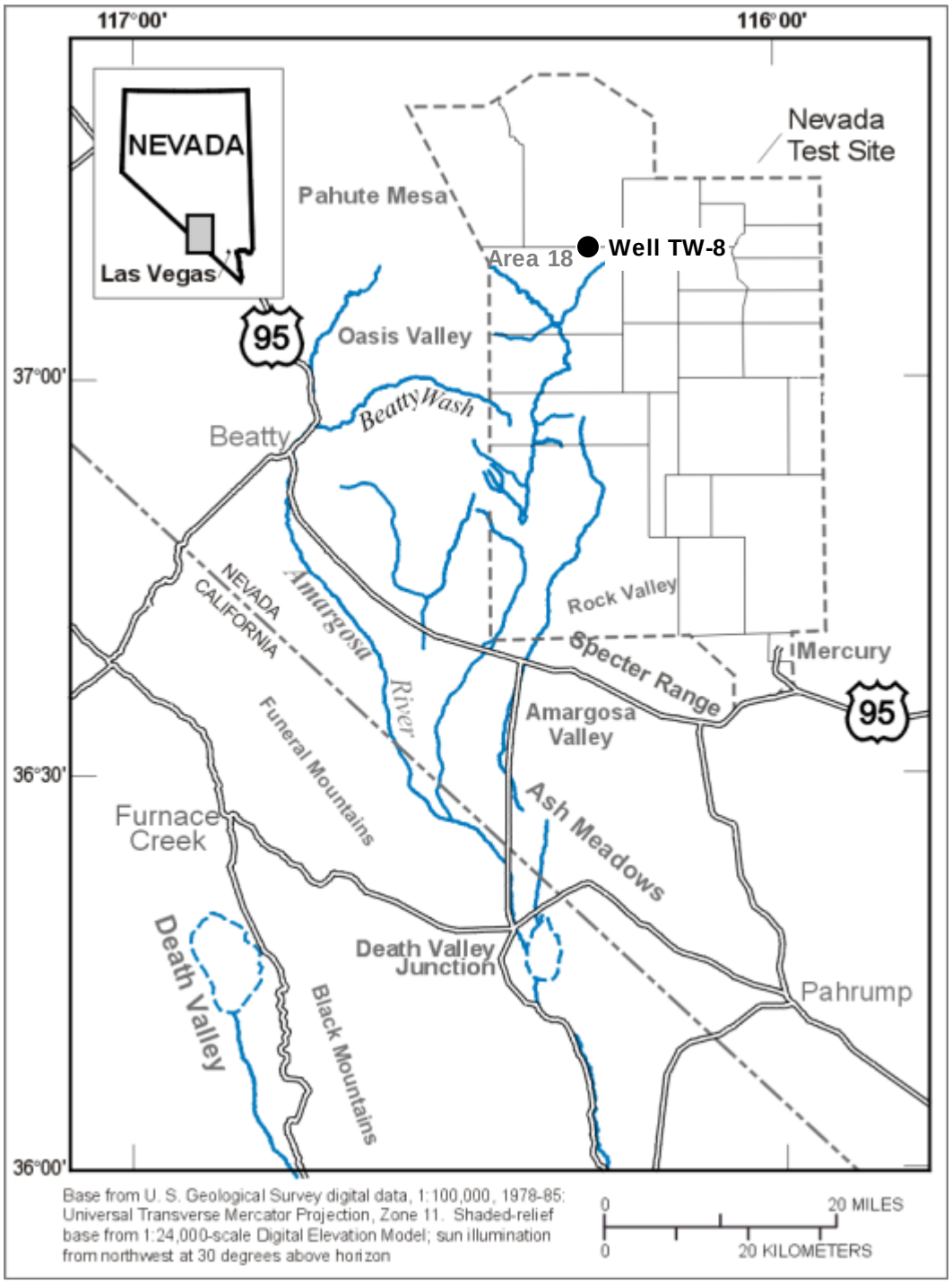

Figure 1 Location of well TW-8 on the Nevada Test Site.

CONSTRUCTION

Well TW-8 was drilled by the U.S. Atomic Energy Commission in support of the Long Range Program of hydrologic studies of the U.S. Geological Survey (Winograd, 1965, p. 1). Well TW-8 was drilled to a depth of 5,490 feet below land surface and was completed with a 13 3/8-inch outside diameter casing from land surface to 33 feet below land surface, a 11 3/4-inch outside diameter casing from 33 to 2,031 feet below land surface, a 7 5/8-inch outside diameter casing from 1,941 to 2,936 feet below land surface, and a 7 5/8-inch diameter open hole from 2,936 to 5,483 feet below land surface, and a 6 1/8-inch diameter open hole from 5,483 to 5,490 feet below land surface (fig. 2). For the January 10 – 11, 1963, aquifer test, a cement bridge plug was set in the 11 3/4-inch casing at a depth of about 1,860 feet. The 11 3/4-inch casing was then perforated at selected intervals from 1,250 to 1,780 feet. The saturated thickness of aquifer tested is assumed to be 530 feet (perforated interval from 1,250 to 1,780 feet).

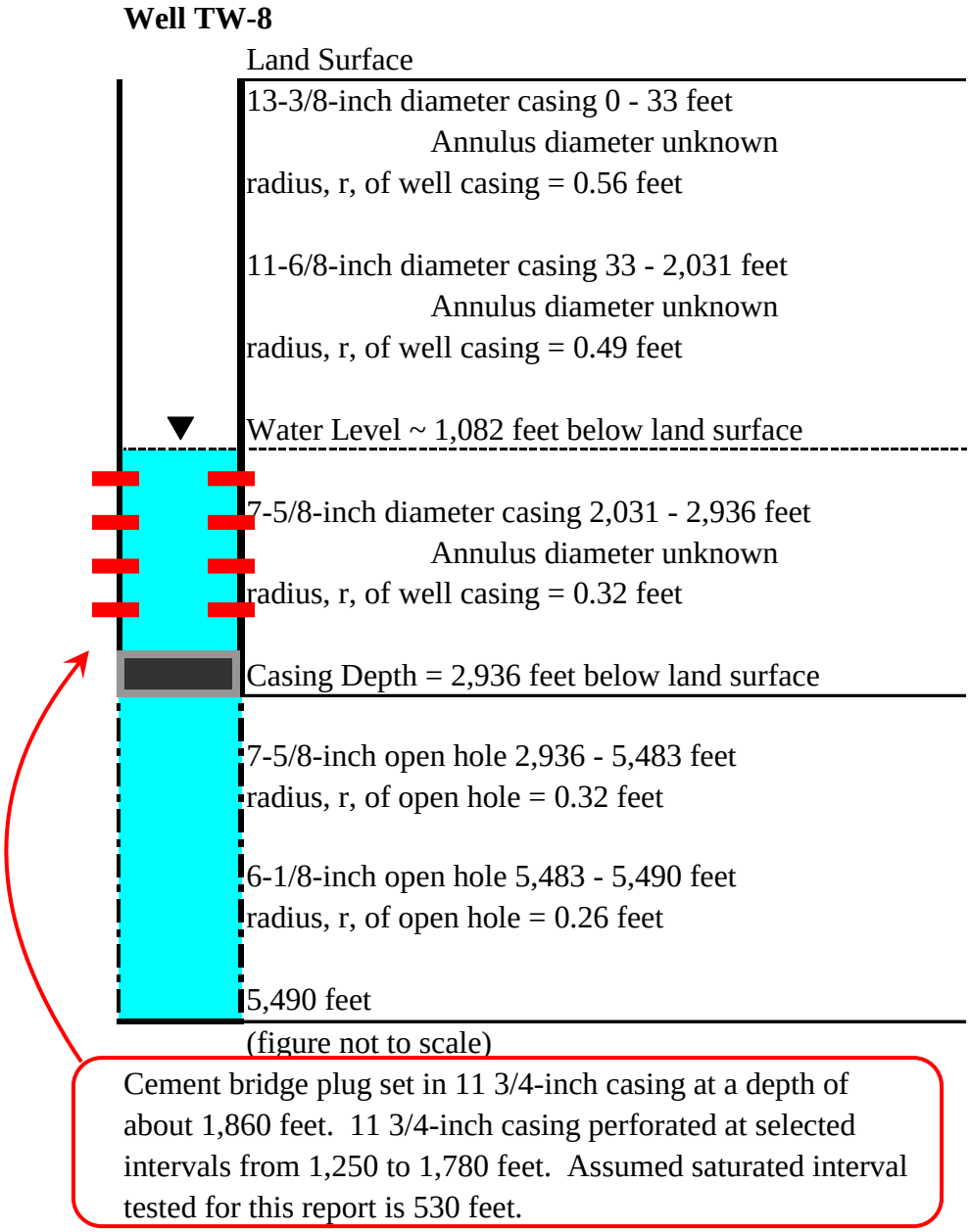

Figure 2 Construction of well TW-8 at time of January 10 – 11, 1963, aquifer test.

HYDROGEOLOGIC CHARACTERISTICS

A detailed description of rock type and stratigraphic units in TW-8 is presented in table 1. This information is from the USGS Ground-Water Site Inventory (GWSI) database.

Table 1 Rock type in well TW-8 from 0 to 5,490 feet below land surface (data from USGS GWSI database)

Depth interval, in feet below land surface	Rock type
0 - 152	Moderately to densely welded ash-flow tuff
152 - 792	Vitric-nonwelded and bedded tuff
792 - 1,128	Rhyolitic lava flow (phenocryst rich)
1,128 - 1,276	Vitric nonwelded to partially welded ash-flow tuff
1,276 - 1,642	Rhyolitic lava flow (phenocryst rich)
1,642 - 1,689	Vitric nonwelded to partially welded ash-flow tuff
1,689 - 2,010	Rhyolitic lava flow (phenocryst rich)
2,010 - 2,248	Zeolitized tuff and tuffaceous sandstone
2,248 - 2,351	Partially welded ash-flow tuff (calc-alkalic)
2,351 - 2,741	Zeolitized bedded and non-welded tuff
2,741 - 3,721	Moderately to densely welded ash-flow tuff
3,721 - 3,888	Zeolitized bedded tuff
3,888 - 5,040	Densely welded ash-flow tuff
5,040 - 5,144	Zeolitized bedded tuff
5,144 - 5,280	Zeolitized tuff
5,280 - 5,490	Tuffaceous conglomerate and sandstone

COOPER-JACOB ANALYSIS

The Cooper-Jacob method (Cooper and Jacob, 1946), commonly referred to as the straight-line method, is a simplification of the Theis (1935) solution for flow to a fully penetrating well in a confined aquifer. Using the Cooper-Jacob method, a transmissivity was estimated to be 11,000 ft^2/d by fitting a straight line to late-time drawdown data (fig. 3). Lohman (1979, p. 22) states that the Cooper-Jacob method is only valid when the well function of u is less than or equal to 0.01 (u = r2 S/4 T t, where r = distance to observation well, S = aquifer storage, T = aquifer transmissivity and t = time of pumpage). Assuming an r of 1 foot and S of 0.001, the criteria of a value of u less than or equal to 0.01 was met after the first second of pumping.

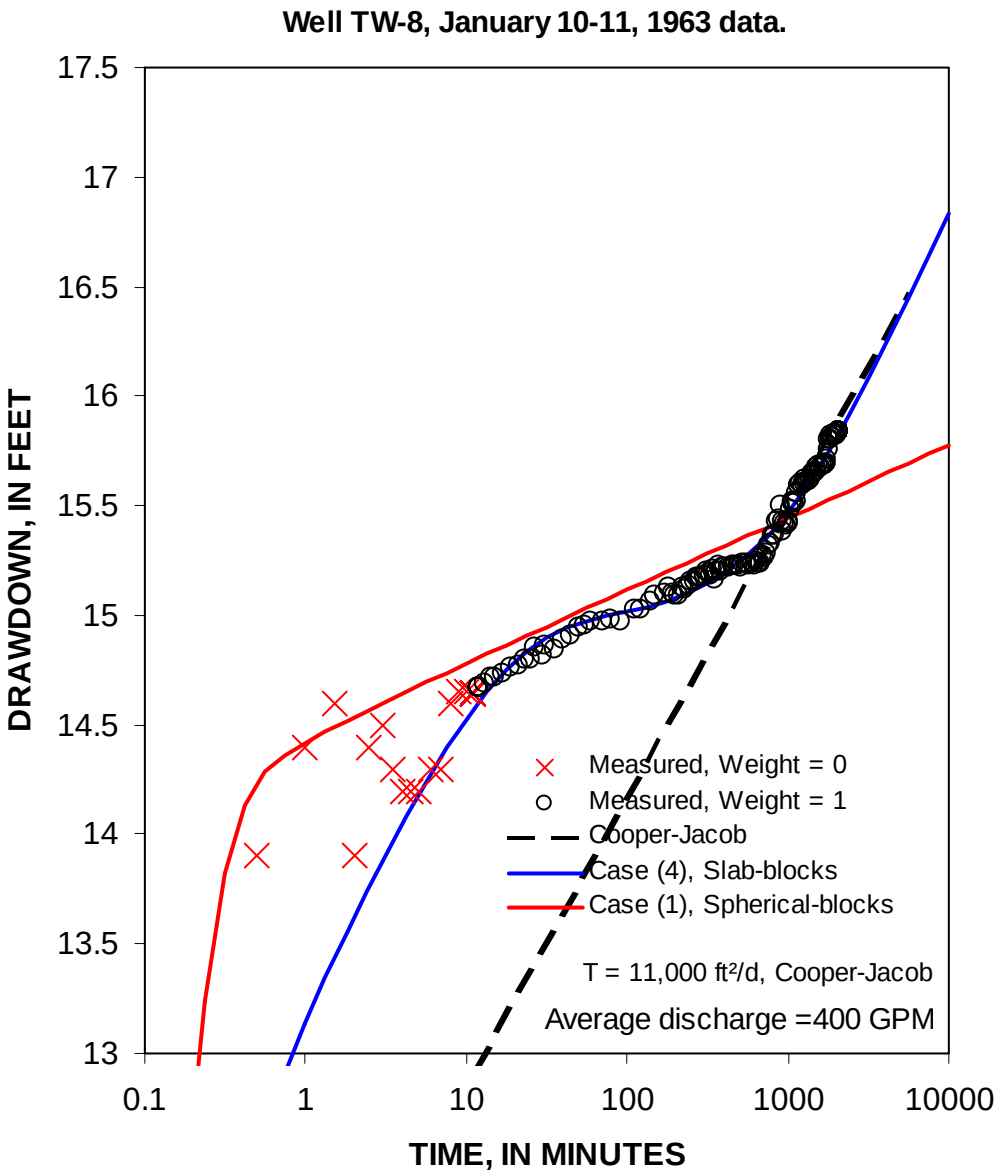

Figure 3 Measured, straight-line approximation, case (4) simulated, and case (1) simulated drawdowns for January 10 - 11, 1963, aquifer test conducted at well TW-8.

MOENCH ANALYSIS

General assumptions about aquifer geometry and hydraulic properties are similar for the Theis and Moench solutions. Common assumptions for both solutions are that aquifers are laterally infinite, have homogeneous and isotropic transmissivities, and are bounded by impermeable confining units. Production and observation wells are assumed to be fully penetrating so that all flow is horizontal. Transmissivity (T) and storage (S) are the same parameters in both solutions.

The Theis and Moench solutions differ in how the release of water from storage is simulated. Water is supplied from aquifer and water compressibility in the Theis solution, which is defined by a single parameter (S). Fractures and blocks of unfractured matrix provide two sources of water in the Moench solution. The first source is from fractures, which contribute water from aquifer and water compressibility in direct proportion to drawdown as defined by a single storage term (S). The second source of water is from the blocks of unfractured matrix that can release water at highly variable rates because the blocks are simulated as one-dimensional aquifers. The blocks of unfractured matrix are characterized by four parameters; slab thickness (2b'), (b' in table 2), fracture skin (Sf), matrix hydraulic conductivity (K'), and matrix specific storage (Ss') (fig. 4). The fracture network also can be conceptualized as spheres instead of slabs in the Moench solution where 2b' defines sphere diameter instead of slab thickness.

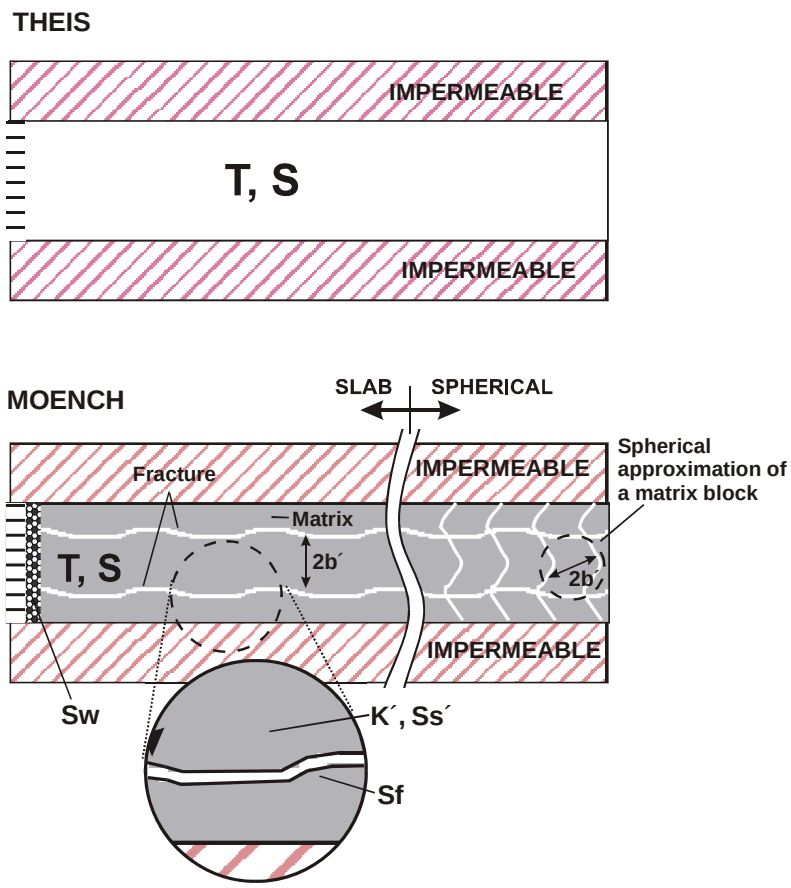

Figure 4 Schematic diagrams of Theis and Moench aquifers.

The range of hydraulic properties that is expected for matrix blocks or slabs is dependent on how the dual-porosity system is conceptualized. Fracture intervals in welded tuffs that are predominantly vertical and recur in intervals of 10 ft or less suggest a spherical approximation of matrix blocks is reasonable. Matrix permeability would be similar to estimates from cores and would have a relatively limited range of expected values if the dual-porosity system were pictured as spheres. Flow logging and packer testing in wells at the Nevada Test Site suggest volcanic interbeds that recur in intervals of 100 to 1,000 ft are the primary permeable zones. This would suggest that the dual-porosity system could be conceptualized as slabs of 100 to 1,000 ft thick. Matrix permeability in the slab conceptualization could be much greater than estimates from cores because the 'matrix' also would be fractured, albeit less well connected than the interbeds.

Multiple conceptualizations of the dual-porosity system around well TW-8 were tested to determine the uniqueness of hydraulic property estimates. Hydraulic properties were estimated by minimizing the sum-of-squares difference between simulated and observed drawdowns after the first 11 minutes of pumping. Drawdowns from the first 11 minutes of pumping were not used because wellbore storage greatly affected these measurements and the accuracy of measured depth-to-water during this timeframe is questionable.

Aquifer geometry was specified and all hydraulic properties except for transmissivity were constrained to reasonable ranges (table 2). Matrix blocks were assumed to have 10-ft diameters for the spherical solutions. Because only 530 feet of saturated aquifer were tested, matrix blocks were assumed to have half the thickness (265-ft) of the aquifer tested for the slab solutions. Matrix specific storage coefficients were limited to range from 10^{-7} to 10^{-5} ft^{-1}. Matrix hydraulic conductivities were limited to range from 10^{-5} to 0.1 ft/d. The skin terms Sf and Sw were estimated, but were constrained to range from 0 to 100.

Estimates of S, b', Sf, K', and Ss' were not unique (table 2). Final estimates of the parameters that were estimated were highly dependent on initial estimates, except for transmissivity. Case 4 and Case 1 had RMS errors of 0.04 to 0.14 ft, respectively, which spans the range of RMS errors for all cases that were tested (table 2). Simulated drawdowns for Case 4 described the observed drawdowns, however, the simulated drawdown for Case 1 did not (fig. 3).

Table 2 Parameter estimates and fitting error for multiple Moench solutions to the observed drawdowns in well TW-8.

[Aquifer thickness is 530 feet. A total of 117 points were used in the analyses. b' is slab thickness or sphere diameter. K is aquifer hydraulic conductivity. Ss is specific storage of fractures. K' is matrix hydraulic conductivity. Sw is wellbore skin. Sf is fracture skin. T is aquifer transmissivity. S is storage coefficient of aquifer. RMS is Root Mean Square.]

Hydraulic Property	CASE							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Slab Geometry[†]	Spherical	Spherical	Slab	Slab	Slab	Slab	Slab	Spherical
Slab, (b'), ft	10 [a]	10 [a]	265 [a]	265 [a]	265 [a]	265 [a]	265 [a]	10 [a]
K, ft/d	78.88	47.02	55.00	17.66	55.11	31.03	20.75 [a]	20.75 [a]
Ss, 1/ft	1.4E-05	1.8E-10	1.8E-05	2.3E-09	1.4E-05	1.8E-10	7.3E-08	1.1E-07
K', ft/d	1.0E-5 [a]	1.0E-1 [a]	1.0E-5 [a]	1.0E-1 [a]	1.0E-5 [a]	1.0E-1 [a]	1.0E-01	8.0E-05
Ss', 1/ft=	2.0E-6 [a]	2.0E-6 [a]	1.0E-7 [a]	1.0E-7 [a]	1.0E-5 [a]	1.0E-5 [a]	3.2E-06	3.7E-06
Sw	43.6	21.7	28.1	0.9	28.0	11.8	4.6	4.7
Sf	0.0	100.0	0.0	40.0	99.8	0.0	0.7	1.2
T, ft^2/d	**42,000**	**25,000**	**29,000**	**9,000**	**29,000**	**16,000**	**11,000 [a]**	**11,000 [a]**
S	8.E-03	1.E-07	1.E-02	1.E-06	7.E-03	1.E-07	4.E-05	6.E-05
RMS error, ft	0.14	0.10	0.10	0.04	0.10	0.08	0.04	0.04

[†] Geometry of matrix in Moench solution which is either slab or sperical.

[a] Values were specified.

CONCLUSIONS

Transmissivity could be reliably estimated around TW-8 with the Cooper-Jacob solution. Estimate of transmissivity from the late time (last limb) of the drawdown data using the Cooper-Jacob solution was 11,000 ft^2/d. Estimates of transmissivity using the Moench solution (Cases 1 – 6) ranged from 9,000 to 42,000 ft^2/d. Transmissivity values for Cases 4 and 6 (9,000 and 16,000 ft^2/d respectively) were within an acceptable range of comparison to the transmissivity determined using the Cooper-Jacob solution. However, transmissivities determined for Cases 2, 3, 5, and 1 (25,000 to 42,000 ft^2/d respectively) were not considered to be in an acceptable range. The curve match for Cases 2, 3, 5, and 1 using the Moench solution was primarily to the middle limb of the drawdown data, whereas the curve match for Cases 4 and 6, matched the middle and last limb of drawdown data.

Although the first 11 minutes of drawdown data were not used because wellbore storage greatly affected these measurements and the accuracy of measured depth-to-water during this timeframe is questionable, it is believed that this period of drawdown represents the first limb of a dual-porosity response and the remaining drawdown data represents limbs 2 and 3. With this assumption, transmissivity could be reliably estimated around well TW-8 with either Cooper-Jacob or a Moench solution from aquifer-test results. With transmissivities only ranging from 9,000 to 16,000 ft^2/d, the value determined using the Cooper-Jacob solution, 11,000 ft^2/d, is assumed to be the best estimate of aquifer transmissivity.

For Cases 4 and 6, final estimates of parameters b', S, Ss, K', Ss', and Sf were dependent on initial estimates and could not be estimated uniquely. Estimates of matrix hydraulic conductivity (K') and fracture skin (Sf) could range over more than four orders of magnitude for models that matched the observed drawdowns equally well.

REFERENCES

Belcher, W. R., and Elliott, P. E., 2001, Hydraulic-property estimates for use with a transient ground-water flow model of the Death Valley Regional Ground-Water Flow System, Nevada and California: U. S. Geological Survey Water-Resources Investigations Report 01-4210, 29 p.

Cooper, H. H. and Jacob, C. E., 1946, A generalized graphical method for evaluating formation constants and summarizing well field history: American Geophysical Union Transactions, v. 27, 526–534 p.

Duffield, G. M., 2000, AQTESOLV for windows, User's Guide: HydroSOLVE, Inc. 164 p.

Lohman, S. W., 1979, Ground-water hydraulics: U. S. Geological Survey Professional Paper 708, 70p.

Moench, A. F., 1984, Double-porosity models for a fissured groundwater reservoir with fracture skin: Water Resources Research, v. 20, no. 7, p. 831-846.

Theis, C. V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground water storage: Transaction of American Geophysical Union, v. 16, 519–524 p.

Winograd, I. J., Pumping test data for selected wells, Nevada Test Site and Vicinity: U. S. Geological Survey Technical Letter: NTS-116, 28 p.

APPENDIX A –TIME/WATER LEVEL/DRAWDOWN RECORDS

Well TW-8, January 10 - 11, 1963, time/drawdown data. Source of data, (Winograd, 1965, pages 20 and 21, Appendix F). Appendix A begins on next page.

DATE TIME	DEPTH TO WATER, IN FEET	ELAPSED TIME, IN MINUTES	DRAWDOWN, IN FEET
01/10/63 04:30:00	1068.00	0.00	0.00
01/10/63 04:30:30	1081.90	0.50	13.90
01/10/63 04:31:00	1082.40	1.00	14.40
01/10/63 04:31:30	1082.60	1.50	14.60
01/10/63 04:32:00	1081.90	2.00	13.90
01/10/63 04:32:30	1082.40	2.50	14.40
01/10/63 04:33:00	1082.50	3.00	14.50
01/10/63 04:33:30	1082.30	3.50	14.30
01/10/63 04:34:00	1082.20	4.00	14.20
01/10/63 04:34:30	1082.20	4.50	14.20
01/10/63 04:35:00	1082.20	5.00	14.20
01/10/63 04:36:00	1082.30	6.00	14.30
01/10/63 04:37:00	1082.30	7.00	14.30
01/10/63 04:38:00	1082.60	8.00	14.60
01/10/63 04:39:00	1082.65	9.00	14.65
01/10/63 04:40:00	1082.65	10.00	14.65
01/10/63 04:41:00	1082.64	11.00	14.64
01/10/63 04:42:00	1082.67	12.00	14.67
01/10/63 04:43:00	1082.69	13.00	14.69
01/10/63 04:44:00	1082.72	14.00	14.72
01/10/63 04:45:00	1082.72	15.00	14.72
01/10/63 04:47:00	1082.73	17.00	14.73
01/10/63 04:49:00	1082.76	19.00	14.76
01/10/63 04:51:00	1082.77	21.00	14.77
01/10/63 04:53:00	1082.80	23.00	14.80
01/10/63 04:55:00	1082.80	25.00	14.80
01/10/63 04:57:00	1082.85	27.00	14.85
01/10/63 05:00:00	1082.82	30.00	14.82
01/10/63 05:01:00	1082.86	31.00	14.86
01/10/63 05:05:00	1082.84	35.00	14.84
01/10/63 05:10:00	1082.89	40.00	14.89
01/10/63 05:15:00	1082.91	45.00	14.91
01/10/63 05:20:00	1082.94	50.00	14.94
01/10/63 05:25:00	1082.95	55.00	14.95
01/10/63 05:30:00	1082.97	60.00	14.97
01/10/63 05:40:00	1082.97	70.00	14.97
01/10/63 05:50:00	1082.98	80.00	14.98
01/10/63 06:00:00	1082.97	90.00	14.97
01/10/63 06:20:00	1083.03	110.00	15.03
01/10/63 06:30:00	1083.03	120.00	15.03
01/10/63 06:50:00	1083.06	140.00	15.06
01/10/63 07:00:00	1083.09	150.00	15.09
01/10/63 07:20:00	1083.10	170.00	15.10
01/10/63 07:30:00	1083.13	180.00	15.13
01/10/63 07:40:00	1083.10	190.00	15.10

DATE TIME	DEPTH TO WATER, IN FEET	ELAPSED TIME, IN MINUTES	DRAWDOWN, IN FEET
01/10/63 07:50:00	1083.09	200.00	15.09
01/10/63 08:00:00	1083.09	210.00	15.09
01/10/63 08:10:00	1083.13	220.00	15.13
01/10/63 08:20:00	1083.12	230.00	15.12
01/10/63 08:30:00	1083.14	240.00	15.14
01/10/63 08:40:00	1083.15	250.00	15.15
01/10/63 08:50:00	1083.15	260.00	15.15
01/10/63 09:00:00	1083.17	270.00	15.17
01/10/63 09:10:00	1083.17	280.00	15.17
01/10/63 09:20:00	1083.17	290.00	15.17
01/10/63 09:30:00	1083.18	300.00	15.18
01/10/63 09:40:00	1083.20	310.00	15.20
01/10/63 09:50:00	1083.19	320.00	15.19
01/10/63 10:00:00	1083.18	330.00	15.18
01/10/63 10:10:00	1083.21	340.00	15.21
01/10/63 10:20:00	1083.16	350.00	15.16
01/10/63 10:30:00	1083.20	360.00	15.20
01/10/63 10:40:00	1083.23	370.00	15.23
01/10/63 10:50:00	1083.20	380.00	15.20
01/10/63 11:00:00	1083.22	390.00	15.22
01/10/63 11:20:00	1083.22	410.00	15.22
01/10/63 11:40:00	1083.22	430.00	15.22
01/10/63 12:00:00	1083.23	450.00	15.23
01/10/63 12:20:00	1083.23	470.00	15.23
01/10/63 12:40:00	1083.23	490.00	15.23
01/10/63 13:00:00	1083.22	510.00	15.22
01/10/63 13:20:00	1083.24	530.00	15.24
01/10/63 13:45:00	1083.24	555.00	15.24
01/10/63 14:05:00	1083.23	575.00	15.23
01/10/63 14:30:00	1083.24	600.00	15.24
01/10/63 14:50:00	1083.23	620.00	15.23
01/10/63 15:10:00	1083.25	640.00	15.25
01/10/63 15:30:00	1083.24	660.00	15.24
01/10/63 15:50:00	1083.24	680.00	15.24
01/10/63 16:10:00	1083.27	700.00	15.27
01/10/63 16:30:00	1083.26	720.00	15.26
01/10/63 16:50:00	1083.28	740.00	15.28
01/10/63 17:10:00	1083.32	760.00	15.32
01/10/63 17:30:00	1083.33	780.00	15.33
01/10/63 17:50:00	1083.36	800.00	15.36
01/10/63 18:10:00	1083.36	820.00	15.36
01/10/63 18:30:00	1083.43	840.00	15.43
01/10/63 19:00:00	1083.44	870.00	15.44
01/10/63 19:20:00	1083.50	890.00	15.50
01/10/63 19:55:00	1083.38	925.00	15.38

DATE TIME	DEPTH TO WATER, IN FEET	ELAPSED TIME, IN MINUTES	DRAWDOWN, IN FEET
01/10/63 20:10:00	1083.43	940.00	15.43
01/10/63 20:30:00	1083.42	960.00	15.42
01/10/63 20:50:00	1083.41	980.00	15.41
01/10/63 21:10:00	1083.43	1000.00	15.43
01/10/63 21:30:00	1083.42	1020.00	15.42
01/10/63 21:50:00	1083.48	1040.00	15.48
01/10/63 22:10:00	1083.51	1060.00	15.51
01/10/63 22:30:00	1083.52	1080.00	15.52
01/10/63 22:50:00	1083.51	1100.00	15.51
01/10/63 23:10:00	1083.52	1120.00	15.52
01/10/63 23:30:00	1083.56	1140.00	15.56
01/11/63 00:00:00	1083.59	1170.00	15.59
01/11/63 00:30:00	1083.60	1200.00	15.60
01/11/63 01:00:00	1083.59	1230.00	15.59
01/11/63 01:30:00	1083.60	1260.00	15.60
01/11/63 02:00:00	1083.62	1290.00	15.62
01/11/63 02:30:00	1083.61	1320.00	15.61
01/11/63 03:00:00	1083.61	1350.00	15.61
01/11/63 03:30:00	1083.62	1380.00	15.62
01/11/63 04:00:00	1083.65	1410.00	15.65
01/11/63 04:30:00	1083.65	1440.00	15.65
01/11/63 05:00:00	1083.65	1470.00	15.65
01/11/63 05:30:00	1083.66	1500.00	15.66
01/11/63 06:00:00	1083.67	1530.00	15.67
01/11/63 06:30:00	1083.68	1560.00	15.68
01/11/63 07:00:00	1083.67	1590.00	15.67
01/11/63 07:30:00	1083.67	1620.00	15.67
01/11/63 08:00:00	1083.68	1650.00	15.68
01/11/63 08:30:00	1083.68	1680.00	15.68
01/11/63 09:00:00	1083.69	1710.00	15.69
01/11/63 09:30:00	1083.69	1740.00	15.69
01/11/63 09:45:00	1083.71	1755.00	15.71
01/11/63 10:00:00	1083.76	1770.00	15.76
01/11/63 10:30:00	1083.80	1800.00	15.80
01/11/63 11:00:00	1083.82	1830.00	15.82
01/11/63 11:30:00	1083.80	1860.00	15.80
01/11/63 12:00:00	1083.81	1890.00	15.81
01/11/63 12:30:00	1083.81	1920.00	15.81
01/11/63 13:00:00	1083.82	1950.00	15.82
01/11/63 13:30:00	1083.83	1980.00	15.83
01/11/63 14:00:00	1083.82	2010.00	15.82
01/11/63 14:30:00	1083.83	2040.00	15.83
01/11/63 15:00:00	1083.84	2070.00	15.84
01/11/63 15:20:00	1083.84	2090.00	15.84