AQUIFER TEST
MARTIN WELLS, OKANOGAN COUNTY, WASHINGTON

At the request of personnel of the Central Region, an aquifer test was conducted on October 11, 12, 13, 1977 near Omak in Okanogan County.

The primary purpose of the test was to determine possible hydraulic continuity between the wells, and aquifer constants.

Three wells were used in the test. The pumped well (RM #2) belongs to Mr. R. Martin and is located in 34/26E-2C2. The two wells which were used for observational purposes are owned by Mr. D. Martin and are 34/26E-2B2 (DM #2) which is 169 feet ESE of the pumped well and 34/26E-2B1 (DM #1) which is 31 feet east of DM#2 and 200 feet ESE of RM#2 (Figure 1).

The wells are developed in an unconfined aquifer of Quaternary age consisting of clasts ranging in size from silt to boulders which were deposited by glacial melt water streams. Outcrops of bedrock throughout the immediate area constitute impermeable boundary conditions which complicate the interpretation of the test data. No significant pumping had taken place for several days before the test and the aquifer was assumed to be essentially in a nonstressed condition.

The electric turbine pump was started at 1140 hrs. on October 11, 1977 and a pumping rate (Q) of 508 gallons per minute (gpm) was quickly established and maintained. Q, determined by timing the filling of a 55 gallon container, was checked repeatedly throughout the 24 hour pumping test. Drawdown measurements were made in all three wells; however, because of difficulties encountered

in getting reliable readings none were taken in the pumped well during the last 18 hours of pumping.

After 24 hours, the water levels in DM#2 and DM#1 had dropped 3.05 feet and 2.63 feet respectively. The pump was shut off and recovery was measured. After 10 hours, wells DM#2 and DM#1 had recovered to within 1.40 ft. and 1.44 ft., respectively, of the static water levels measured at the beginning of the test. The pumped well (RM#2) had recovered to within 1.33 ft. of the prepumping level. Copies of all data are attached.

The drawdown data for the observation well DM#2 were plotted on logarithmic graph paper (Fig. 2) and using the curve corresponding to the latter part of the test and the Theis type curve, a transmissivity (T) of 2.9×10^4 gallons per day per foot (gpd/ft) and a storage coefficient (S) of .07 were determined.

Using the following formulae and constants, one can investigate withdrawal/drawdown possibilities. It is stressed that the calculated figures are probably conservative because of the likelihood of additional impermeable boundaries.

$$U = \frac{1.87 \times r^2 \times S}{T \quad t \text{ days}} \qquad s = \frac{114.6 \; Q \times Wu}{T}$$

$T = 2.9 \times 10^4$ gpd/ft $\qquad S = .07$
$r = 169$ ft (distance from RM#1 to DM#2)

A groundwater certificate for 600 gpm and 400 AF/yr for the irrigation of 100 acres from RM#1 has been issued. Of the 100 acres, 80 acres is for land belonging to Ralph Martin and 20 acres is for land owned by Dean Martin.

If the place of withdrawal for the irrigation of 20 acres were changed to DM#2, the following would apply:

RM#2 - 480 GPM and 320 AF/yr for Irr. of 80 acres

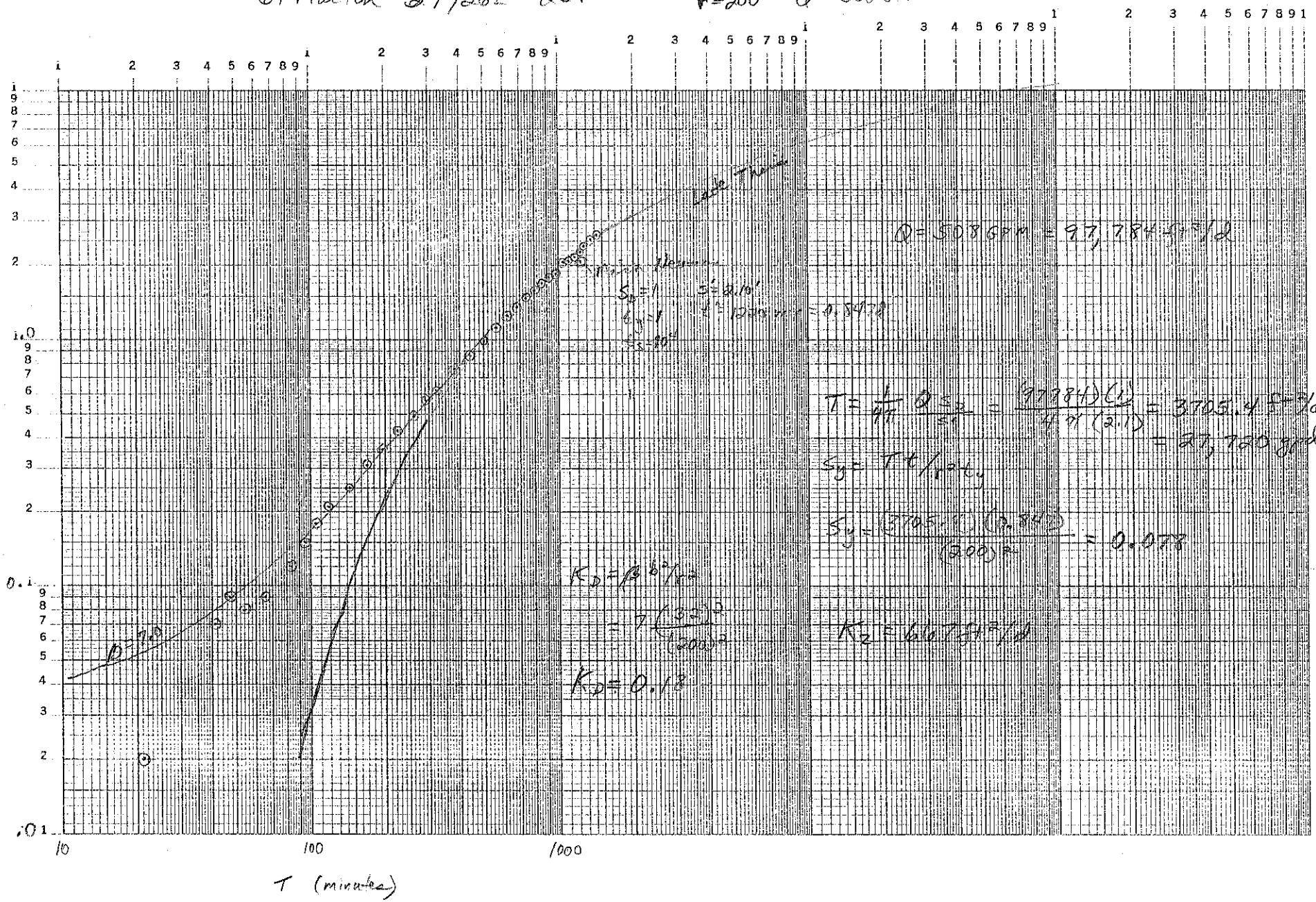
DM#2 - 120 GPM and 80 AF/yr for Irr. of 20 acres

If the total amounts were applied uniformly throughout the irrigation season (April 1 to October 1 or 180 days), the instantaneous withdrawals from RM#2 would average 400 gpm and from DM#2 100 gpm. At the end of the irrigation season, the drawdown resulting from pumping of RM#2 would be about 27 ft at RM#2 and 11 ft at DM#2; pumping at DM#2 would result in a drawdown of 7 ft. at DM#2 and 3 ft. at RM#2. Total drawdown would be 30 ft. at RM#2 and 18 ft. at DM#2. Reportedly there is about 30 ft. of water above the pump intake in RM#2; the above withdrawals are the upper limits under present conditions. Pumping of the DM#2 well at 800 GPM as applied for is not feasible.

46 7520

D. Martin 34/26E-28.1

b = 32' sat. thickness
r = 200' Q = 508 GPM



$Q = 508\ GPM = 97,784\ ft^3/d$

$T = \frac{1}{4\pi} Q \frac{W_u}{u} = \frac{(97784)(.4)}{4\pi(2.1)} = 3705.4\ ft^2/d$
$= 27,720\ gpd/ft$

$S_y = T t / r^2 K_y$

$S_y = \frac{(3705.4)(2.8 \times 10^{-2})}{(200)^2} = 0.078$

$K_D = K_z b / r^2$

$= 7 \frac{(32)^2}{(200)^2}$

$K_D = 0.18$

$K_z = K_h / K_v$

$400\ AF \times 3.259 \times 10^5 = 1.30 \times 10^8$ GALLONS

$600 AF \times$ " $= 1.96 \times 10^8$ GALLONS

IF PUMP 600 GPM CONTINUOUSLY – 150 DAYS TO PUMP 400 AF.

" " 800 GPM " 170 DAYS TO PUMP 600 AF

AFTER 150 DAYS OF CONTINUOUS PUMPING
BY R. MARTIN (600 gpm) & D. MARTIN (800 gpm)
THE D/D's WOULD BE:

R. MARTIN –

AT 1' AWAY

$$U = \frac{1.87 \times 1 \times .08}{3.3 \times 10^4 \times 150} = 3.02 \times 10^{-8} \qquad Wu = 16.74 \qquad s = \frac{114.6 \times 600 \times 16.74}{3.3 \times 10^4} = 34.88'$$

AT $r = 169'$

$$U = \frac{1.87 \times 169^2 \times .08}{3.3 \times 10^4 \times 150} = 8.63 \times 10^{-4} \qquad Wu = 6.48 \qquad s = 13.50'$$

D. MARTIN –

ONE FOOT FROM WELL $U = 3.02 \times 10^{-8}$ $Wu = 16.74$ $s = \frac{114.6 \times 800 \times 16.74}{3.3 \times 10^4} = 46.51'$

169' FEET FROM WELL $U = 8.63 \times 10^{-4}$ $Wu = 6.48$ $s = 18'$

D/D AT R. MARTIN's WELL 53' & D/D AT D. MARTIN's WELL 60'

3/7

D. MARTIN HAS 30' OF WATER IN WELL (73' TO 103')

R. MARTIN HAS 30' " " " " (73' TO ?) ASSUMES

i.e. $s = 30'$ $Q = 400$ gpm FROM R.M's & D.M's WELLS

$$W(u) = \frac{s \times T^{gpd/ft}}{114.6 \times Q^{gpm}} = \frac{15 \times 3.3 \times 10^4}{114.6 \times 400} = 10.80 \quad u = 2.34 \times 10^{-10}$$

$$t_{days} = \frac{1.87\, r^2 S}{T u}$$

1 FOOT FROM PUMPED WELL

$$t_{days} = \frac{1.87 \times 1 \times .08}{3.3\ 10^4 \times 2.34\ 10^{-10}} = \frac{1.87 \times 8 \times 10^{-2} \times 10^6}{3.3 \times 2.34} = 19373 \text{ Days}$$

160 FEET FROM PUMPED WELL ———

R M HAS ONLY 80 AC OF 100 AC - IRR. ACREAGE

$\frac{80}{100} \times 600 = 480$ gpm $\rightarrow$ 320 AF/YR.

D.M. HAS RIGHT TO $\frac{20}{100} \times 600 = 120$ gpm $\rightarrow$ 80 AF/YR

IRR SEASON APR 1 TO OCT 1

IF R.M. IRR CONTINUOUSLY AT 480 gpm

AND PUMPS ~~NO MORE THAN~~ 320 AF/YR ($= 1.04 \times 10^8$ G)

IN 151 DAYS

DRAWDOWN 1' FROM R MARTIN:

$U = \frac{1.87 \times 1 \times .08}{3.3 \times 10^4 \, 151} = 3.00 \times 10^{-8}$ $W_U = 16.7449$

$s_1 = \frac{114.6 \times 480 \times 16.75}{3.3 \times 10^4} = 27.92'$

D/D 169' FROM PUMPED WELL $U = \frac{1.87 \cdot 169^2 \cdot .08}{33 \times 10^4 \cdot 151} = 8.57 \, 10^{-4}$ $W_U = 6.48$

$s_{169} = \frac{114.6 \times 480 \times 6.48}{3.3 \times 10^4} = 10.80'$

IF D.MARTIN PUMPS SIMULTANEOUSLY AT 120 gpm HE WILL HAVE W/DRAWN 80 AF IN 151 DAYS

I' FROM DM WELL $U = 3.00 \times 10^{-8}$ $W_U = 16.7449$

$s_1 = \frac{114.6 \times 120 \times 16.75}{3.3 \times 10^4} = 6.98'$

D/D 169' FROM DM WELL $U = 8.57 \times 10^{-4}$ $W_U = 6.48$

$s_{169} = \frac{114.6 \times 120 \times 6.48}{3.3 \times 10^4} = 2.7'$

D/D ~~R.M. WELL~~ W/ R.M W/DRAWING 480 GPM CONTINUOUSLY FOR 151 DAYS & D.M. W/DRAWING 120 GPM FOR 151 DAYS:

R.M. WELL $27.9' + 2.7' = 30.6'$

D.M " $7.0 + 10.8 = 17.8'$

IF RM & DM EXTEND PUMPAGES THROUGHOUT IRR SEASON (APR 1 – OCT 1) OR 180 DAYS,

$Q_{RM} \cong 400\text{gpm} \times 180\text{ DAYS} = 320\text{ AF/YR}$

DD = 1 FT FROM RM WELL

$U = \frac{1.87 \times 1 \times .08}{3.3 \times 10^4 \times 180} = 2.5 \times 10^{-3}$ (2.9 × 10⁻⁴) $W_u = 16.93$

$s_1 = \frac{114.6 \times 400 \times 16.93}{3.3 \times 10^4} = 23.52'$ (2.9 × 10⁻⁴) = 26.96

DD 169 FT FROM RM WELL

$U = \frac{1.87 \cdot 169^2 \cdot .08}{3.3\ 10^4 \times 180} = 7.2 \times 10^{-4}$ (2.9 × 10⁻⁴) $W_u = 6.66$

$s_{169} = \frac{114.6 \times 400 \times 6.66}{3.3 \times 10^4} = 9.25'$ (2.9 × 10⁻⁴) = 10.53

$Q_{DM} \cong 100\text{gpm}$ (× 180 DAYS = 80 AF/YR)

DD 1 FT FROM DM WELL

$U = 2.5 \cdot 10^{-3}$ $W_u = 16.93$

$s_1 = \frac{114.6 \times 100 \times 16.93}{3.3 \times 10^4} = 5.88'$ (2.9 × 10⁻⁴) = 6.69'

DD 169 FT FROM DM WELL

$U = 7.2 \times 10^{-4}$ $W_u = 6.66$

$s_{169} =$ 2.31' (2.63')

D/D AT RM WELL – 26.9 + 2.6 = 29.4'

" " DM " 6.7' + 10.5' = 17.2'

MAINTAIN R.M WELL AT 400 GPM & 180 DAYS OF CONTINUOUS PUMPING

ALLOW D/D AT R.M WELL TO REACH ~~25~~ 30 FEET. WHAT CAN D.M PUMP OVER 180 DAY INTERVAL?

$S_{RM} = \cancel{25'}\ 30'$ WL IN R.M WELL IS DRAWN DOWN
$\cancel{+1}\ 26'$ i.e. INCREASED PUMPAGE BY D.M CAN REDUCE WL IN R.M WELL BY $30 - 26 = 4'$

$$S_{(DM)_{180}} = 4 = \frac{114.6\, Q W.U}{T} \Rightarrow Q = \frac{4 \times 3.3\,10^{4}}{114.6 \times 6666} = 173\,GPM$$

$$S_{DM_1} = \frac{114.6 \times 173 \times 1693}{3.3\,10^{4}} = 10.17$$

D/D AT D.M WELL PUMPING AT 173 GPM
AND R.M " " " 400 GPM
IS $10.17 + 9.25 \cong 30'$

TREATMENT OF THESE WELLS PUMPING AT 550 GPM FOR 180 DAYS. WHAT IS = AT r = 1 ?

$$u = \frac{1.87 \times 1 \times .08}{13.3 \times 10^{4} \times 180} = 2.51 \times 10^{-8} \qquad W(u) = 16.9$$

$$s = 32.38'$$

r = ? ΔT s = 1'

$$W(u) = \frac{s \times T}{114.6\ Q} = 0.52 \qquad u = 5.3 \times 10^{-1}$$

$$r = \left(\frac{u T t}{1.87 \times S}\right)^{1/2} = 4587'.$$

AQUIFER TEST

R MARTIN & G. MARTIN WELLS

OCT. 1977

CALCULATIONS

$$U = \frac{1.87 \times r^2 S}{T \, t_{days}} \qquad s = \frac{114.6 \, Q \times W(u)}{T}$$

$$T = \left(\frac{3.7 + 2.9}{2}\right) 10^4 = 3.3 \times 10^4 \text{ gpd/ft}$$

2.9×10^4 gpd/ft

$S = .08$ (.07)

$r = 169$ FT

$$U = \frac{1.87 \times r^2 .08}{3.3 \times 10^4 \, t_{days}} \qquad s = \frac{114.6 \, Q \times W(u)}{3.3 \times 10^4}$$

R MARTIN	600 gpm	400 AF/YR
D. MARTIN	800 gpm	600 AF/YR

1 FOOT FROM PUMPED WELL

$$U = \frac{1.87 \times 1^2 .08}{3.3 \times 10^4 \, t_{day}} = \frac{4.53 \times 10^{-6}}{t_{day}}$$

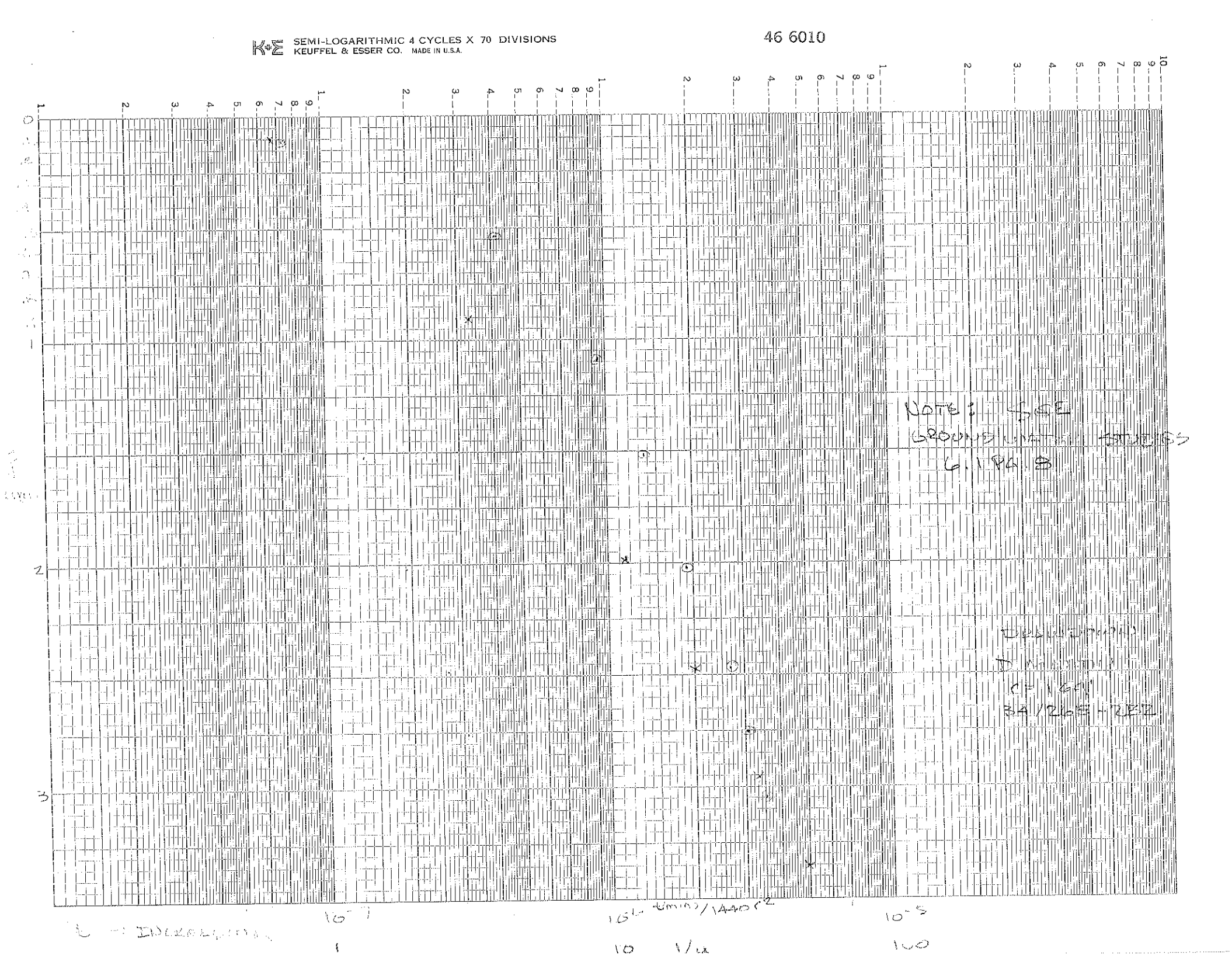
11.7336

1 DAY $W(u) = 11.7336$

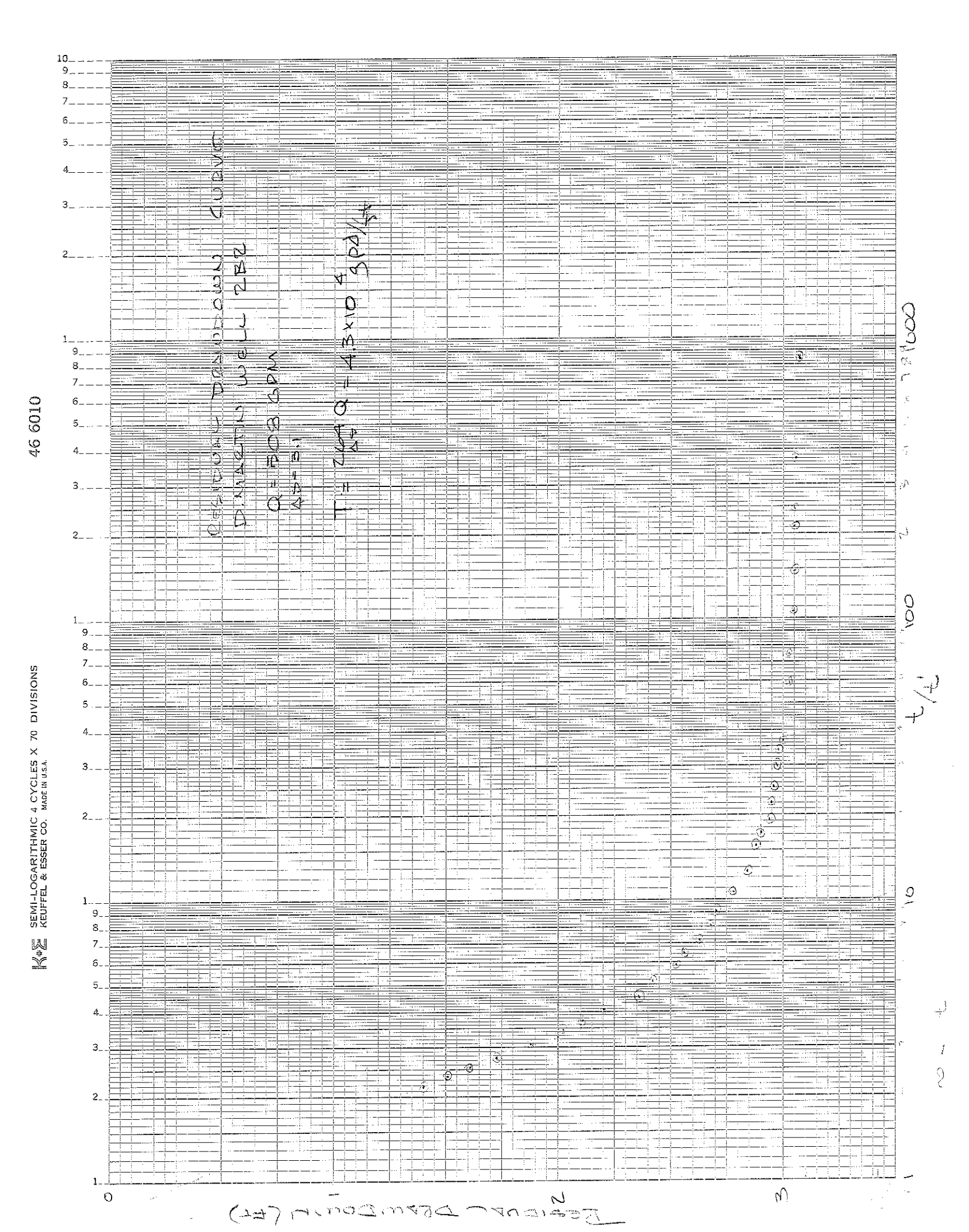
$$s_{(1' \& 1 day)} = \frac{114.6 \times 600 \times 11.7336}{3.3 \times 10^4} = 24.45 \text{ FT}$$

D/D AT D MARTIN'S WELL ($r = 169'$) $t_{days} = 1$

$$U = \frac{1.87 \times 169^2 \times .08}{3.3 \times 10^4} \quad .13 \qquad s = \frac{114.6 \times 600 \times 1.5889}{3.3 \times 10^4} = 3.31 \text{ FT}$$



[illegible]	$+/1440\ r^2$	$W(0)$	$1/v$
[illegible]	$7.29\ 10^{-7}$	1.90	67
[illegible]	[illegible]	.91	3.33
[illegible]	[illegible]	1.97	11.76
2.48	2.65 "	2.47	20.0
2.02	1.95 "	2.96	3.33
1.52	1.37 "	3.35	50.0
1.09	$9.36\ 10^{-6}$		
53	$4.13\ 10^{-6}$		


46 6010
SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
Recovery Drawdown (ft)
0
2
3
100
1000
t/t'

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AQUIFER TEST

Sheet 1 of 2

Owner R. MARTIN Location 34/26E-2C2 Well No. PUMP.

Date 10-11-77 (TUES) Meas. by W.W.M & PG Test PUMP. County OK

Meas. point 1.1' A.G.L. Elev. Meas. Point ACCESS HOLE BELOW PUMP

Meas. equipment E-TAPE

DTW_o 74.52 t_o 1140HRS Q 508 GPM r 0

Date	t Hour	Water level			s	t (MIN)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10/11(77)	1140.00	90.5	15.4.8	74.52	0.0	0.0		
	1.30	105	-3.21	86.79	12.27	1.5		
	2.	105	-2.34	87.66	13.14	2.0		
	3		-0.81	89.13	14.61	3.0		
	4		-.67	89.33	14.81	4.0		
	4.30	105	-.15	90.00	15.48	4.5		
	5	105.16	-.15	90.16	15.64	5.0		
	6	105.45	-.15	90.45	15.93	6.0		
	7	105.63		90.63	16.11	7.0		
	11:00	106.32		91.32	16.80	11		
	12	106.48		91.48	16.96	12		
	13	106.54		91.54	17.02	13		
	14	106.64		91.64	17.12	14		
	15	106.76		91.76	17.24	15		
	16	106.84		91.84	17.32	16		
	12:00 20	107.14		92.14	17.62	20		
	12:05 25	107.40		92.40	17.88	25		
	12:10 30	107.38		92.38	17.86	30		
	12:30 35	108.05		93.05	18.53	35		TAPE OFF ↓
	12:30 40	107.62		92.62	18.10	40		
	12:35 45	110-	-1.42	93.68	19.16	45		
	12:40 50	110	-1.12	93.88	19.36	50		
	12:50 60	110	-0.89	94.11	19.59	60		TAPE PROBLEMS

EGY 070-37

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AQUIFER TEST

Sheet 2 of 2

Owner Ralph Martin Location 34/26E-2C2 Well No. PUMPING

Date 10-11-77 Meas. by WWM & PG Test DRAWDOWN PUMP. County OK

Meas. point ______ Elev. Meas. Point ______

Meas. equipment ______

DTW_0 74.52 t_0 1140 HRS Q 508 GPM r = 0'

Date	Hour	Water level Held	Wet	Depth (DTW)	s	t	$\frac{1440r^2}{t}$	Remarks
10/11/77	1250 70	110	-16.14	93.86	19.34	70		
	1300 80	110	-15.55	94.45	19.93	80		
	1310 90		-15.33	94.67	20.15	90		
	1320 100	110	-15 —	95.00	20.48	100		
	110	110.56	-15-	95.56	21.04	110		
		110.62	15	95.62	21.10	130		
	1420	110.75	"	95.75	21.23	160		
	1505	110.91	15	95.91	21.39	205		
	1535	112.10	"	97.10	21.58	235		
	1610	112.21	"	97.21	21.69	270		TAPE HANGING UP - PULLED TAPE - RDG GOOD - RUN IN CAREFULLY
	1700	111.02	"	96.02	21.50	320		
	1755	110.82	"	95.82	21.30	375		
	1855	113.05	"	98.05	23.53	435		GOOD MEASUR.?
		NO MEASUREMENTS						HAVING PROBLEMS
								GETTING RELIABLE
								READING —

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AQUIFER TEST

Sheet 1 of 3

Owner R. MARTIN (WELL) Location 34/26E-7C2 Well No. _____

Date 10-12-77 Meas. by W.W.M. Test REC County OK.

Meas. point 1.1Δ GAL – HOLE IN BASE OF PUMP Elev. Meas. Point _____

Meas. equipment E-TAPE

DTW_o 74.52 t_o 1200 HRS Q _____ r 0

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10/12/77	1200.5	100	-5	85		.5		
		100	-5	83.72		1.0		
		100	-5	82.27		2.0		
		3.82		81.82		3.0		
		2.46		81.46		4.0		
		2.24		81.24		4.5		
		2.12		81.12		5		
		2.98		80.98		6		
		2.82		80.82		7		
		2.70		80.70		8		
		2.61		80.61		9		
		2.49		80.49		10		
		2.42		80.42		11		
		2.32		80.32		12		
		2.28		80.28		13		
		2.20		80.20		14		
	1215	2.13		80.13		15		
	1220	2.11		80.11		20		
	1225	1.68		79.68		25		
	1230	1.46		79.46		30		
	1235	1.29		79.29		35		
	1240	1.14		79.14		40		
	12	1.02		79.02		45		

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Recovery

AQUIFER TEST

Sheet 2 of 3

Owner R. MARTIN Location 34/26E-2C Well No. 1

Date (WED) 10-12-77 Meas. by WWM, PG, LR Test REC County OK.

Meas. point 1.1 AGL Elev. Meas. Point

Meas. equipment E. TAPE

DTW$_0$ 74.52 t_0 1200 4-25 Q [illegible] r 0

Date	Hour	Water level Held	Wet	Depth (DTW)	s	t	$\frac{1440r^2}{t}$	Remarks
10/12	1250	93.91	-15	78.9		50		
	1300	93.95	-5			60		
	1310	94.03	NO	GOOD		70		LOST WEIGHT [illegible]
	1315	93.46				75		NEW WEIGHT
	1320	93.38				80		
	1330	93.28				90		
	1341	93.13				101		
	1400	92.93				120		
	1420	92.79				140		
	1500	92.49				180		
	1535	92.32				215		
	1605	92.21	-15	77.21		245		
	1635	92.10				275		
	1705	92.00				305		
	1805	91.86				365		
	1905	91.72		76.72		425		
	2005	91.64		76.72		485		
	2105	91.55		76.55		545		
	2220	91.50		76.50		605		
	2307	91.41		76.41		667		
10/13	0005	91.30		76.30		725		
	0105	91.26		76.26		785		
	0205	91.16		76.16		845		

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Rec.

AQUIFER TEST

Sheet 3 of 3

Owner R. MARTIN Location 34/26E-7C2 Well No. ______

Date 10/13/22 Meas. by L. Q. Test Rec. County OK.

Meas. point ______ Elev. Meas. Point ______

Meas. equipment 1.1' AGL

DTW_0 74.52 t_0 1200 HRS Q ______ r 0

Date	Hour	Water level: Held	Wet	Depth (DTW)	s	t	$\frac{1440r^2}{t}$	Remarks
[illegible]	0312	91.13						
	0410	91.05						
	0510	91.00						
	0610	90.95						
	0709	90.95						
	[illegible]	90.93						
	0830	90.85		75.85				1.33' BELOW W.L. AT BEGIN. OF TEST

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AQUIFER TEST

Sheet 1 of 2

Owner D. MARTIN Location 34/26S-2B1 Well No. OBS (CAPPED)

Date 10/11/77 Meas. by PG, WWM Test D/D County LK.

Meas. point LOW. EDGE OF SLOT IN CASING Elev. Meas. Point 1.0 AGL

Meas. equipment E-TAPE

DTW_o 73.76 t_o 11.40 Q 508 GPM r 200'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10/11/77	1140	75.16	1.40	73.76	0	0		THIS IS ORIG. WELL
			"	"	0	7 MIN.		TAPE IS 1.40' SHORT
			"	73.78	.02	21		Q:
	1221				.07	41 MIN		55 GAL IN 6.5 SEC
					.09	47		= 508 GPM
		75.24		73.84	.08	59		
	1246	75.25			.09	66		
		75.28		73.88	.12	83		
		75.31			.15	95		
		75.34			.18	104		
		75.37			.21	119		
	1402	75.41			.25	142		
	1430	75.47			.31	170		
	1454	75.52			.36	194		
	1524	75.59			.43	224		
	1558	75.65			.49	258		
	1632	75.73			.57	292		
	1705	75.78			.62	325		
	1800	75.92		74.52	.76	380		
	1900	76.03			.87	440		
	2000	76.15			.99	500		
	2100	76.29			1.12	560		
	2200	76.38			1.24	620		

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AQUIFER TEST

Sheet 2 of 2

Owner [redacted] Location 34/26 E-28 1 Well No. OBS 1 (ABN'D & CAPPED)

Date 10/11 & 12/77 Meas. by PG, WWM, LR Test D/D County OK.

Meas. point LOW. EDGE OF SLOT IN CASING Elev. Meas. Point 1.6' AGL

Meas. equipment E. TAPE

DTW$_o$ 73.76 t_o 1140 Q 50 GPM r 31' 200'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
	[illegible]	[illegible]	-1.4	75.12	1.36	[illegible]		
	[illegible]	[illegible]			1.48	[illegible]		
TUES. WED (10-12-77)	[illegible]	[illegible]			1.60	[illegible]		
	[illegible]	[illegible]			1.70	[illegible]		
	[illegible]	[illegible]			1.79	920		
	[illegible]	[illegible]			1.85	980		
	[illegible]	[illegible]			2.06	1040		
	[illegible]	[illegible]			2.09	1100		
	[illegible]	[illegible]			2.17	1160		
	[illegible]	[illegible]			2.29	1220		
	[illegible]	[illegible]			2 39	1270		31.0' E. OF D. MARVIN'S PRESENT PER. WELL.
	[illegible]	[illegible]			2.51	1355		
	1015	77.67						
	1130	77.79	-1.4	76.39	2.63	1430		

5M Y 070-37

Department of Ecology

DEPARTMENT OF ECOLOGY
WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

AQUIFER TEST

Sheet 1 of 2

Owner D. MARTIN Location 34/26E-2B1 Well No. OBS 1 (CAPPED)

Date 10-12-77 Meas. by PG, WWM, LR Test REC. County OK.

Meas. point LOW EDGE OF SLOT IN CASING Elev. Meas. Point 1.0' AGL

Meas. equipment E-TAPE

DTW$_o$ 73.76 t_o _____ Q _____ r 200'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10-12-77	1200	77.78	1.4	76.38	0	0		PUMP OFF
		77.96			—	30		t = TIME SINCE
		77.85			—	45		PUMP OFF
		77.86			—	75		
		77.85			—	90		
		77.85			—	105		
		77.85			—	120		
		77.84			—	150		
		77.77			.01	185		
		77.74			.04	210		
	1400	77.71			.07	240		
	1627	77.67				267		
	1657	77.63				297		
	1800	77.56				360		
	1900	77.48				420		
	2000	77.36				480		
	2100	77.31				540		
	2200	77.22				600		
	2300	77.19				660		
	2400	77.07				720		
	0100	77.00				780		
	0200	76.93				840		
	0300	76.89						

BCY 070-37

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WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

Rec

AQUIFER TEST

Sheet 2 of 2

Owner D. MARTIN Location 34/26E-2B1 Well No. OBS. 1 (NO PUMP)

Date 10-13- Meas. by L.R. Test Rec County OK

Meas. point _____ Elev. Meas. Point _____

Meas. equipment _____

DTW_o _____ t_o _____ Q _____ r 200'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10/13	0400	76.85						
	0500	76.77						
	0600	76.71						
	0700	76.65						
	0800	76.61						
	0835	76.60	-1.4	75.20				FINAL
				73.76				WL IS 1.44'
				1.44'				BELOW DTWo

ECY 070-37

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WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

AQUIFER TEST

Sheet 1 of 3

Owner D. MARTIN Location 34/26E – 2B2 E OF GRESHAM RD. Well No. 2 OBS. (W/PUMP)

Date 10/11/77 Meas. by PG Test D/D County OK.

Meas. point LOWER EDGE OF SLOT IN CSG. Elev. Meas. Point 2.1 AGL

Meas. equipment E. TAPE (FISHER M-SLOPE)

DTW_o 75.38' t_o 1140+45 Q 508 GPM r 169'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10/11/77	1140	76.38	-1.0	75.38	0	0	∞	TAPE IS 1.0 SHORT
					0	.5	8.23×10^7	Q: 55 GALLONS
					0	1.0	4.11×10^7	IN 6.5 SEC.
					0	1.5	2.7×10^7	
					UP 0.01	3.5	1.18×10^7	
					0	5.0	8.23×10^6	
				75.40	+.02	9.5	4.33×10^6	
				75.42	.04	11.0	3.74×10^6	
					.05	13.0	3.16×10^6	
	1155			75.435	.055	15.0	2.74×10^6	
					.06	17.0	2.42×10^6	
					.07	20.0	2.06×10^6	
					.09	25.0	1.65×10^6	
					.11	30.0	1.37×10^6	
					.13	35.0	1.18×10^6	
					.145	40.0	1.03×10^6	
					.16	45.0	9.14×10^5	
	1230				.185	50.0	8.23 "	
					.21	60.	6.85 "	
	1250				.24	70	5.88 "	
	1300				.28	80	5.14 "	
					.31	90	4.57 "	
	1320				.34	100	4.11 "	

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DRAWDOWN

AQUIFER TEST

Sheet 2 of 3

Owner D. MARTIN Location 34/26E-28R Well No. 2(w/PUMP) OBS:

Date 10-11-77 Meas. by TG, WWM, LR Test D/D County OK

Meas. point LOWER EDGE OF SLOT IN CASING Elev. Meas. Point 2.1 AGL

Meas. equipment E-TAPE

DTW_o 75.38 t_o 1140 (10-11-77) Q 50 GPM r 169

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10-11-77	1330	76.75			.37	110	3.74×10^5	
	1405				.47	145	2.84 "	
	1430	76.91			.53	170	2.42 "	
	1500				.61	200	2.06 "	
	1528				.67	228	1.80 "	
	1600	77.14			.76	260	1.58 "	
	1635				.86	295	1.39 "	
	1709				.94	327	1.26 "	
	1805				1.09	385	1.07 "	
	1900				1.21	440	9.35×10^4	
	2004				1.93	504	8.16 "	
	2105				1.52	565	7.28 "	
	2203				1.64	623	6.60 "	
	2304				1.83	688	5.98 "	
10-12-77	0004				1.88	744	5.53 "	
	0103				2.02	803	5.12 "	
	0203				2.09	863	4.77 "	
	0309				2.22	923	4.46 "	
	0404				2.32	984	4.18 "	
	0505				2.38	1045	3.94 "	
	0604				2.48	1104	3.73 "	
	0703				2.58	1163	3.54 "	
	0803				2.69	1223	3.36 "	

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DRAWDOWN

AQUIFER TEST

Sheet 3 of 3

Owner D. MARTIN Location 34/26E-2B2 Well No. 2 (OBS. W/PUMP)

Date 10-12-77 Meas. by L.R. Test D/D County OK.

Meas. point LOWER EDGE OF SLOT IN CASING Elev. Meas. Point 2.1' AGL

Meas. equipment E TAPE

DTW_o 75.38 t_o 1140 (10-11-77) Q 500GPM r 169'

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
10-12-77	9:00				2.76	1280	3.21×10^4	31' TO 2B1
	10:30	80.00 - 0.66	-79.34	78.34	2.94	1370	3.00 "	
	11:45	80.00 - 0.55	-79.45	78.45	3.05	1445	2.85 "	
	12:00					1460		PUMP OFF

10-12-77

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AQUIFER TEST

Sheet 1 of 2

Owner D. MARTIN Location 34/26E 2B2 Well No. OBS: 2 (W/PUMP)

Date 10-12-77 Meas. by PG Test REC. County OK.

Meas. point ACCESS SLOT-LOW EDGE Elev. Meas. Point 2.1' AGL

Meas. equipment FISHER M-SLOPE

DTW$_o$ 75.38 t_o _____ Q _____ r 169'

Date	Hour	Water level			RESIDUAL DRAW DOWN	t'	$\frac{1440r^2}{t/t'}$	Remarks
		Held	Wet	Depth (DTW)				
10-12-77	1200	80.00 - .55	79.45	78.45	3.07	0	—	PUMP OFF
		-.54		78.46	3.08	2.0	731	(PUMP HAD BEEN
		-.56		78.44	3.06	4.0	366	ON 1460 MIN.)
		-.57		78.43	3.05	6.0	244	t = time (min)
		"		"	"	7.0	210	since pump on.
		"		"	"	10.0	147	t' = time (min)
		.58		78.42	3.04	14.0	105	since pump off.
		.59		78.41	3.03	20.0	74	
		.59		"	"	25.0	59	PULLED TAPE -
		.62		78.38	3.00	42.0	36	ONLY
		.64		78.36	2.98	45.0	33	
		.65		78.35	2.97	50.0	30	
		.66		78.34	2.96	62.0	25	
		.67		78.33	2.95	70.0	22	
		.68		78.32	2.94	80.0	19	
		.72		78.28	2.90	90.0	17.2	
	1340	.74		78.26	2.88	100.0	15.6	
		.78		78.22	2.84	125.0	12.7	
		.84		78.16	2.78	153.0	10.5	
		.91		78.09	2.71	183.0	8.98	
	1530	.94		78.06	2.68	210.0	7.95	
		.99		78.01	2.63	240.0	7.08	
	1630	1.06		77.94	2.56	270	6.41	

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AQUIFER TEST

RECOVERY

Sheet 2 of 2

Owner D. MARTIN Location 34/26E-2B2 Well No. OBS 2 (W/ PUMP)

Date 10-12-77 Meas. by PG, WWM, LR Test REC County OKO

Meas. point ACCESS SLOT-LOW EDGE Elev. Meas. Point 2.1' AGL

Meas. equipment E-TAPE

DTW_o 75.38 t_o _____ Q _____ r 169'

Date	Hour	Water level			Read DTW	t'	$\frac{1440r^2}{t}$ / $\frac{t'}{t}$	Remarks
		Heid	Wet	Depth (DTW)				
10-12-77	1700	80.00 -1.10	78.90	77.90	2.52	300	5.87	TAPE IS 1.0 SHORT
	1800	1.20	78.80	77.80	2.42	360	5.06	
	1900				2.36	420	4.48	
	2000				2.20	480	4.04	
	2103				2.11	543	3.69	
	2200				2.02	600	3.43	
	2300				2.00	660	3.21	
	2400				1.88	720	3.03	
10-13-77	0100				1.92	780	2.87	
	0200				1.73	840	2.74	
	0305				1.67	905	2.61	
	0403				1.61	963	2.52	
	0505				1.55	1025	2.42	
	0605				1.51	1085	2.35	
	0703				1.44	1143	2.28	
	0803				1.42	1203	2.21	
	0840				1.40	1240	2.18	1.40 BELOW SWL AT BEGIN OF TEST

HARRY HUBBARD
RIVERSIDE, WASH.

No. 7651 Dept. _____ Date 7/8 1927

Name Dean Martin Well #2

Omak Washington

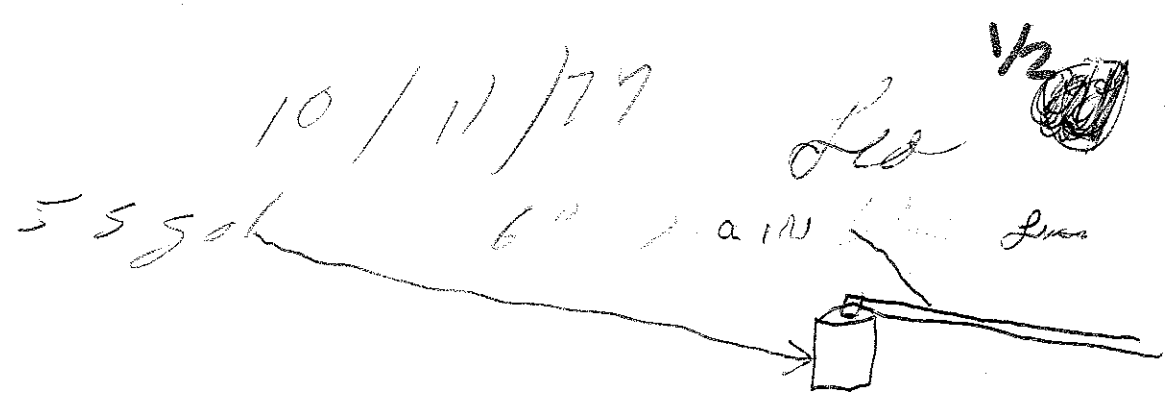
CASH	C. O. D.	CHARGE	ON ACCT.	MDSE. RETD.	PAID OUT

QUAN.	DESCRIPTION	PRICE	from	To
	Top soil		0	4
	bolders + gravel		4	33
	compact gravel + bolders			
	three inch down		33	45
	gravel + bolders		45	51
	gravel		51	63
	gravel + bolders three			
	inch down + sand + water		63	86
	sand + gravel + water		86	106
	bed rock		106	
	perforated 8 holes around 13 rounds with 104 holes			
	static water 80'			
	surface casing grouted			
	20 feet			

Rec'd By

KEEP THIS SLIP FOR REFERENCE

10/11/77



10-11-77

1- 1141 AM - 6 Sec
2- 1144 " - 6½ Sec
3- 1146 AM - 6½ Sec
4- 1148 AM - 6½ Sec
5- 1150 AM - 6½ Sec
6- 1152 AM - 6½ Sec
7- 1154 AM - 6½ Sec
8- 1156 AM - 6½ Sec
9- 1158 AM - 6½ Sec
10- 1200 PM 6½ Sec
11- 1201 PM 7 Sec
12- 1203 PM 6½ Sec
13- 1205 PM 6½ Sec
14- 1207 PM 6½ Sec
15- 1209 PM 7 Sec
16- 1211 PM 6½ Sec
17- 1213 PM 7 Sec
18- 1215 PM 6½ Sec
19- 1217 PM 6½ Sec
20- 1219 PM 6½ Sec
21- 1221 PM 7 Sec
22- 1223 PM 6½ Sec
23- 1225 PM 6½ Sec
24- 1227 PM - 6½ Sec
25- 1229 PM - 7 Sec
26- 1231 PM - 6½ Sec
27- 1233 PM - 6½ Sec
28- 1235 PM - 6½ Sec
29- 1237 PM 7 Sec
30- 1239 PM 6½ Sec
31- 1241 PM 6½ Sec
32- 1243 PM 7 Sec
33- 1245 PM 6½ Sec
34- 1247 PM 6½ Sec
35- 1.00 PM 6½ Sec
36- 1.05 PM 6½ Sec
37- 1.25 PM 6½ Sec
38- 1.40 PM 6½ Sec
39- 1.47 PM 7 Sec
40- 1.50 PM 6½ Sec
41- 1.55 PM 6½ Sec
42- 1435 6½ "
43- 1520 6½ "
44- 1630 6½ "
45- 1715 6½ "
46 1915 7 "

47 [illegible] 7 Sec.

48 2210 6.5 Sec

49 0010 7.0 Sec 10-12-77

50 0212 6.8 Sec

51 0403 6.5 Sec.

52 0609 - 6.5 Sec.

53-0708 - 6.5 Sec

54-0810 - 6 Sec

55 - 1125 - 6.5 Sec 10 12 77

AQUIFER TEST
MARTIN WELLS, OKANOGAN COUNTY, WASHINGTON

At the request of personnel of the Central Region, an aquifer test was conducted on October 11, 12, 13, 1977 near Omak in Okanogan County.

The primary purpose of the test was to determine possible hydraulic continuity between the wells, and aquifer constants.

Three wells were used in the test. The pumped well (RM #2) belongs to Mr. R. Martin and is located in 34/26E-2C2. The two wells which were used for observational purposes are owned by Mr. D. Martin and are 34/26E-2B2 (DM #2) which is 169 feet ESE of the pumped well and 34/26E-2B1 (DM #1) which is 31 feet east of DM#2 and 200 feet ESE of RM#2 (Figure 1).

The wells are developed in an unconfined aquifer of Quaternary age consisting of clasts ranging in size from silt to boulders which were deposited by glacial melt water streams. Outcrops of bedrock throughout the immediate area constitute impermeable boundary conditions which complicate the interpretation of the test data. No significant pumping had taken place for several days before the test and the aquifer was assumed to be essentially in a nonstressed condition.

The electric turbine pump was started at 1140 hrs. on October 11, 1977 and a pumping rate (Q) of 508 gallons per minute (gpm) was quickly established and maintained. Q, determined by timing the filling of a 55 gallon container, was checked repeatedly throughout the 24 hour pumping test. Drawdown measurements were made in all three wells; however, because of difficulties encountered

in getting reliable readings none were taken in the pumped well during the last 18 hours of pumping.

After 24 hours, the water levels in DM#2 and DM#1 had dropped 3.05 feet and 2.63 feet respectively. The pump was shut off and recovery was measured. After 10 hours, wells DM#2 and DM#1 had recovered to within 1.40 ft. and 1.44 ft., respectively, of the static water levels measured at the beginning of the test. The pumped well (RM#2) had recovered to within 1.33 ft. of the prepumping level. Copies of all data are attached.

The drawdown data for the observation well DM#2 were plotted on logarithmic graph paper (Fig. 2) and using the curve corresponding to the latter part of the test and the Theis type curve, a transmissivity (T) of 2.9×10^4 gallons per day per foot (gpd/ft) and a storage coefficient (S) of .07 were determined.

Using the following formulae and constants, one can investigate withdrawal/drawdown possibilities. It is stressed that the calculated figures are probably conservative because of the likelihood of additional impermeable boundaries.

$$U = \frac{1.87 \times r^2 \times S}{T \ t \text{ days}} \qquad s = \frac{114.6 \ Q \times Wu}{T}$$

$T = 2.9 \times 10^4$ gpd/ft $\qquad S = .07$
$r = 169$ ft (distance from RM#1 to DM#2)

A groundwater certificate for 600 gpm and 400 AF/yr for the irrigation of 100 acres from RM#1 has been issued. Of the 100 acres, 80 acres is for land belonging to Ralph Martin and 20 acres is for land owned by Dean Martin.

If the place of withdrawal for the irrigation of 20 acres were changed to DM#2, the following would apply:

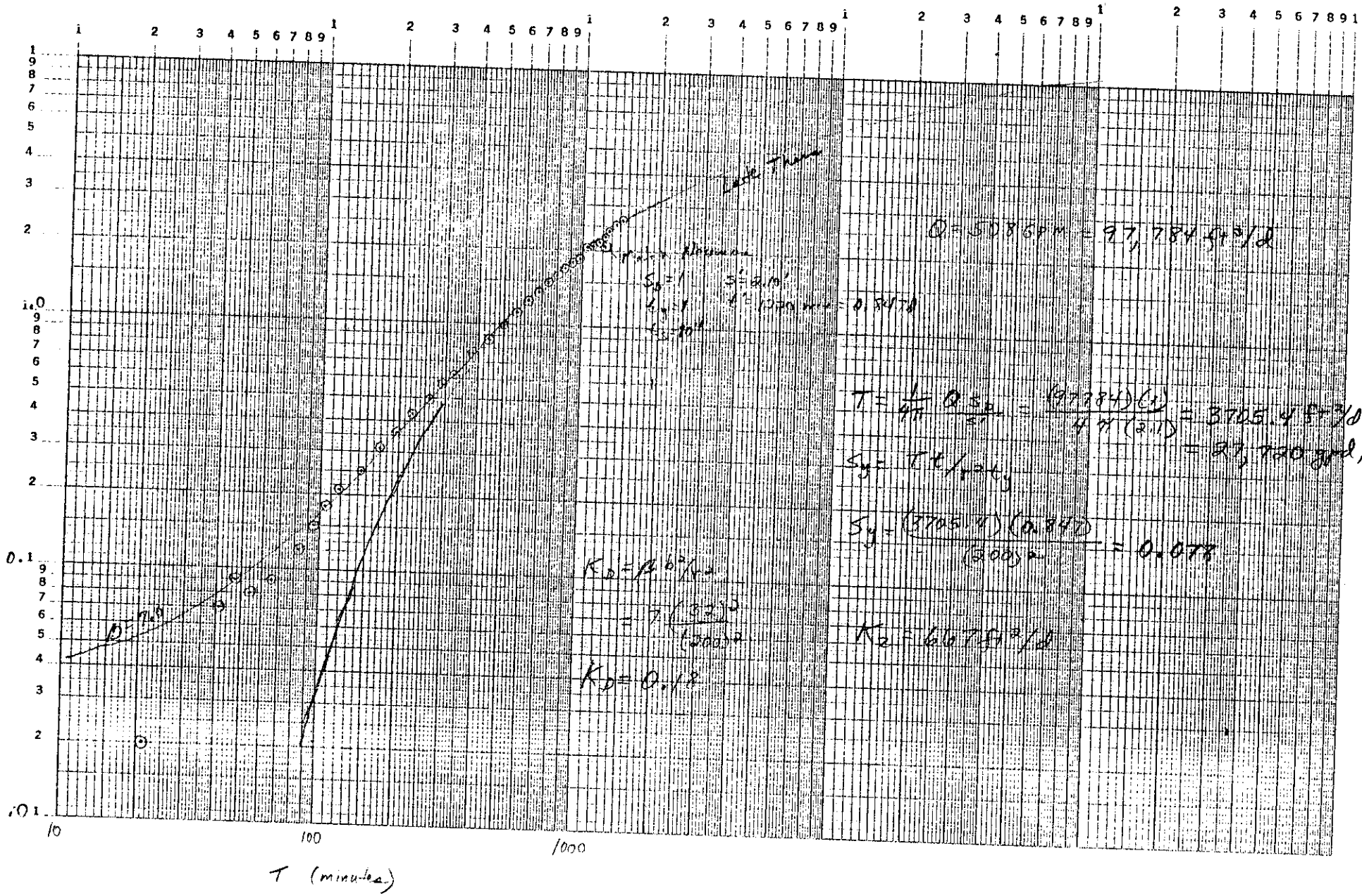
RM#2 - 480 GPM and 320 AF/yr for Irr. of 80 acres

DM#2 - 120 GPM and 80 AF/yr for Irr. of 20 acres

If the total amounts were applied uniformly throughout the irrigation season (April 1 to October 1 or 180 days), the instantaneous withdrawals from RM#2 would average 400 gpm and from DM#2 100 gpm. At the end of the irrigation season, the drawdown resulting from pumping of RM#2 would be about 27 ft at RM#2 and 11 ft at DM#2; pumping at DM#2 would result in a drawdown of 7 ft. at DM#2 and 3 ft. at RM#2. Total drawdown would be 30 ft. at RM#2 and 18 ft. at DM#2. Reportedly there is about 30 ft. of water above the pump intake in RM#2; the above withdrawals are the upper limits under present conditions. Pumping of the DM#2 well at 800 GPM as applied for is not feasible.

D. Martin 34/26E - 25 1

b = 32' sat. Thickness
r = 700' Q = 508 GPM



$Q = 508\ GPM = 97,784\ ft^2/d$

$T = \frac{1}{4\pi} \frac{Q}{\Delta s} = \frac{(97784)(1)}{4\pi(2.1)} = 3705.4\ ft^2/d$

$= 27,720\ gpd/ft$

$S_y = T t / r^2 K_y$

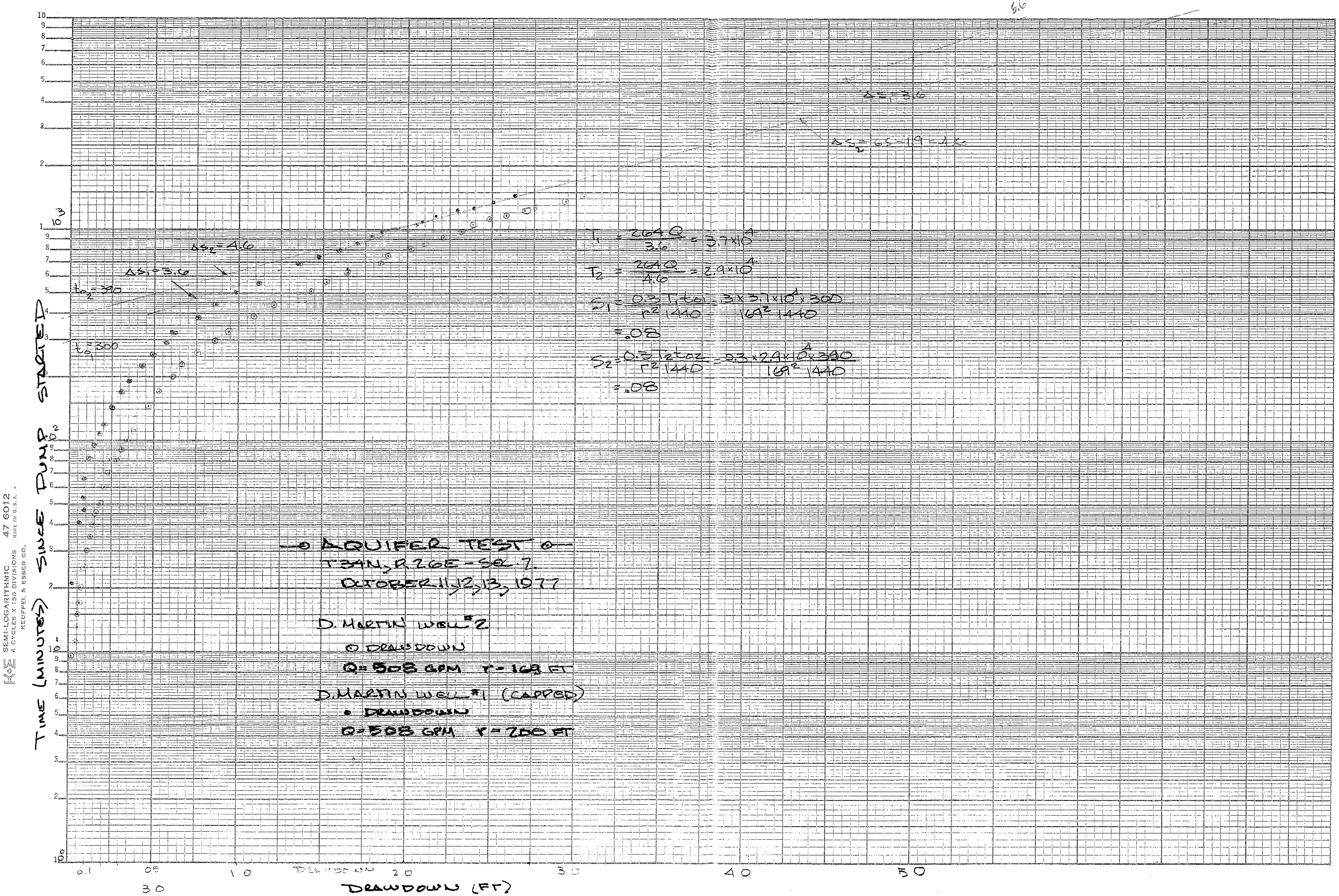
$S_y = \frac{(3705.4)(0.847)}{(700)^2} = 0.078$

$K_D = K_z b^2 / r^2$

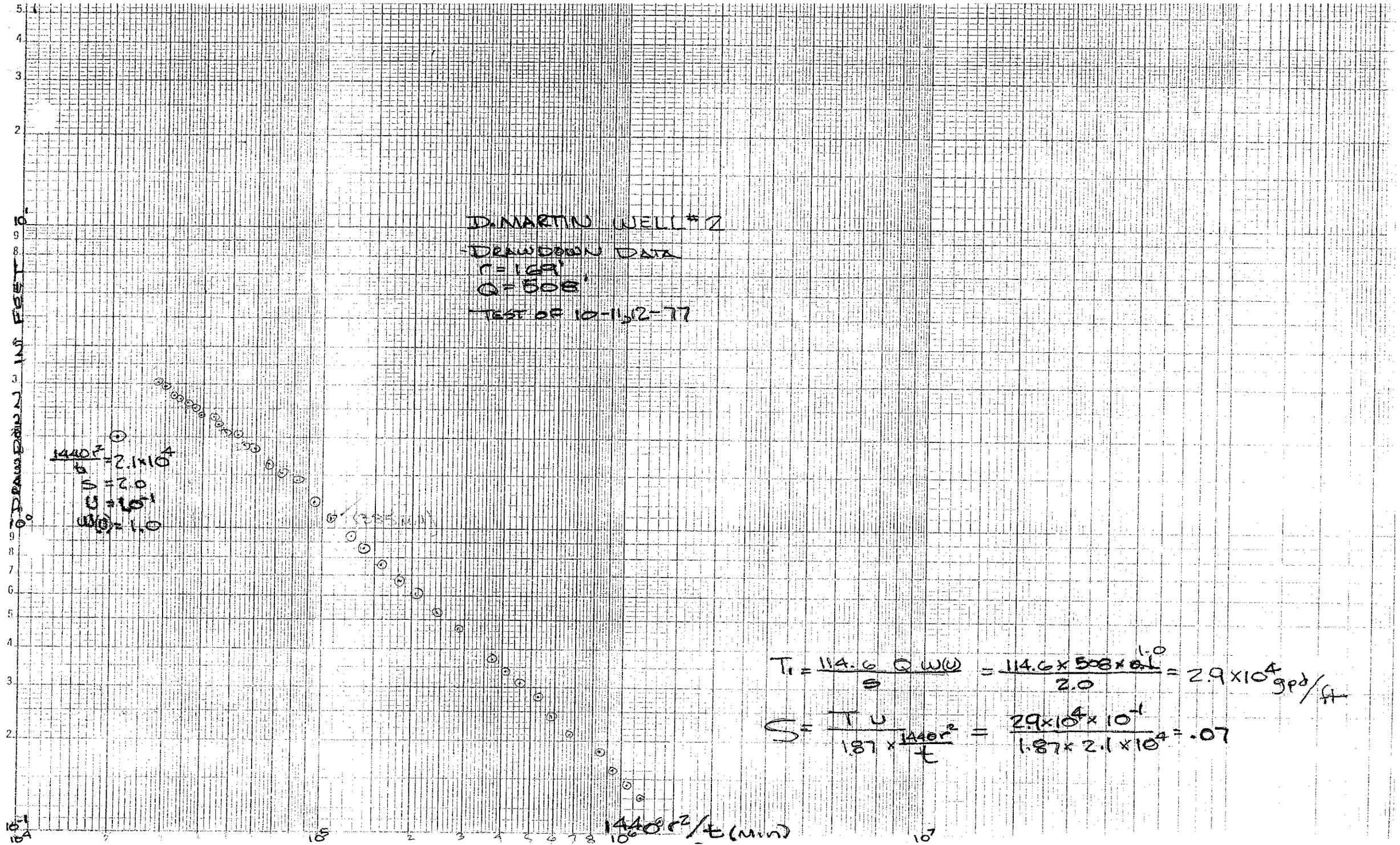
$= \frac{7}{(700)^2}$

$K_D = 0.18$

$K_z = 68.7\ ft^2/d$



AQUIFER TEST
T34N, R26E - SEC. 7.
OCTOBER 11, 12, 13, 1977
D. MARTIN WELL #2
⊙ DRAWDOWN
Q=508 GPM r=169 FT
D. MARTIN WELL #1 (CAPPED)
• DRAWDOWN
Q=508 GPM r=200 FT
T₁ = 264 Q / 3.6 = 3.7×10⁴
T₂ = 264 Q / 4.6 = 2.9×10⁴
S₁ = 0.3 T₁ t₀₁ / r² 1440 = .3 × 3.7×10⁴ × 300 / 169² 1440
= .08
S₂ = 0.3 T₂ t₀₂ / r² 1440 = 0.3 × 2.9×10⁴ × 340 / 169² 1440
= .08
ΔS₁ = 3.6
ΔS₂ = 4.6
ΔS₂ = 6.5 - 1.9 = 4.6
t₀₂ = 340
t₀₁ = 300
TIME (MINUTES) SINCE PUMP STARTED
DRAWDOWN (FT)
SEMI-LOGARITHMIC
4 CYCLES X 150 DIVISIONS
KEUFFEL & ESSER CO.
47 6012
MADE IN U.S.A.



$$T_1 = \frac{114.6\ Q\ W(u)}{s} = \frac{114.6 \times 508 \times 1.0}{2.0} = 2.9 \times 10^4 \text{ gpd/ft}$$

$$S = \frac{T\ u}{187 \times \frac{1440r^2}{t}} = \frac{2.9 \times 10^4 \times 10^{-4}}{1.87 \times 2.1 \times 10^4} = .07$$