

## AQUIFER TEST ON WELL 18/25-15E IN GRANT COUNTY, WASHINGTON

### Introduction

A six-day drawdown and recovery test was conducted from March 8-14, 1977 on well 18/25-15E near George in Grant County. Purpose of the test was to determine the transmissivity and storage of the deep basalt aquifer and the degree of interconnection between the shallow basalt (upper 200 feet) and the deep basalt.

The pumped well (18/25-15E), drilled in 1975, is 975 feet deep, cased 343 feet and open 635 feet in the deep basalt. Two cored wells near the test site were used as observation wells. The first well (George) is 60 feet west of the pumped well. The well is 373 feet deep, cased 173 feet, and open 200 feet in the shallow basalt. The second well (Martha) is 700 feet south of the pumped well. The well is 831 feet deep, cased 360 feet, and open 471 feet in the deep basalt. The depth and casing relationship of the three wells are shown in Figure 1.

Water levels measured during the test included the pumped well, two observation wells, and seven deep irrigation wells ranging in depth from 515 to 756 feet, located within a 5-mile radius of the pumped well. Also, four deep-irrigation wells were periodically pumped before and during the test period. The test well, the wells measured, and the pumped irrigation wells are shown in approximate location with each other in Figure 2.

## Test Results

A 10-inch Sparling meter measured the discharge from a motor-driven, deep-well turbine in well 18/25-15E. The discharge averaged 2402 gallons per minute, and was piped about 200 feet east into a shallow basin. Discharge measurements taken during the test are shown in Table 1.

The pumped well was measured by airline gage since there was no access port in the well casing to lower a probe. The airline measurements (Table 2) indicated about 21 feet drawdown in the pumped well after 70 hours of pumping, but the measurements are not accurate enough for aquifer analysis. The measurements of the George observation well (Table 3), 60 feet west of the pumped well, show only about 1 1/3 foot of drawdown at the end of the pumping period, which indicate that the degree of inter-connection between the shallow and deep basalt is quite small. The measurements taken at the George well were not used in the analysis.

The depth to water of all measured wells during drawdown and recovery are plotted with the pumped intervals of the four irrigation wells to illustrate the effect the irrigation wells had on the water levels of the measured wells (Figure 3). Water levels measured in the Martha and Department of Natural Resources wells (Tables 4 and 5) appear to show the least interference from irrigation pumpage and so are used to calculate the transmissivity and storage of the deep basalt aquifer by the log-log and semi-log methods. The drawdown and recovery plot with time and computations are shown in Figures 4 to 7 and summarized

in Table 6. The computed transmissivities range from about 151,000 gallons per day per foot (gpd/ft) to 163,000 gpd/ft, and the storage coefficients from 7.6 to  $9.6 \times 10^{-4}$ . A transmissivity of 160,000 gpd/ft and storage of  $8.0 \times 10^{-4}$  are best estimates of the aquifer coefficients under the conditions of the test. These values are based on the data obtained during the recovery period when interference from irrigation pumpate was minimal.

Depth, in feet

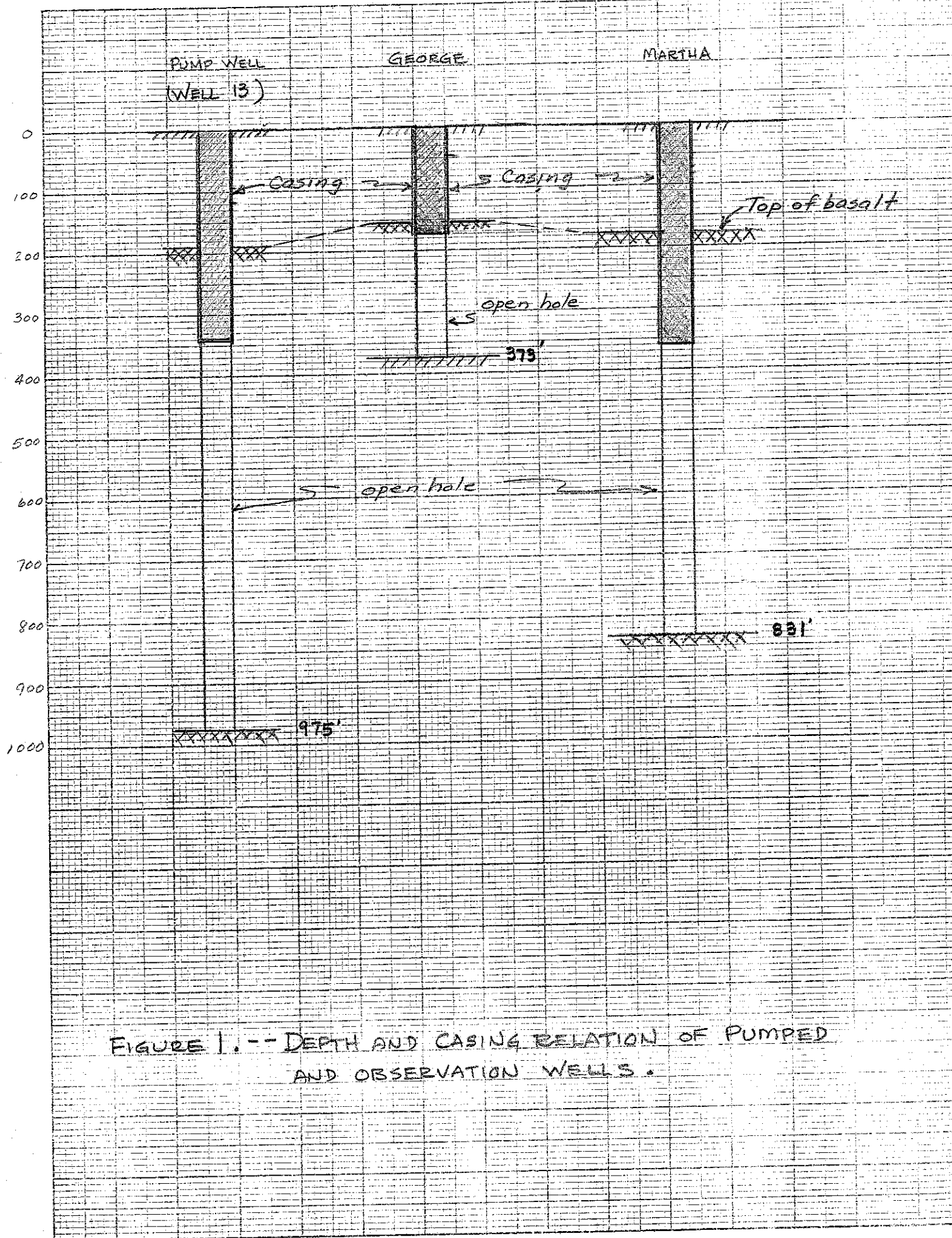


FIGURE 1. -- DEPTH AND CASING RELATION OF PUMPED AND OBSERVATION WELLS.

R 26E

R 25E

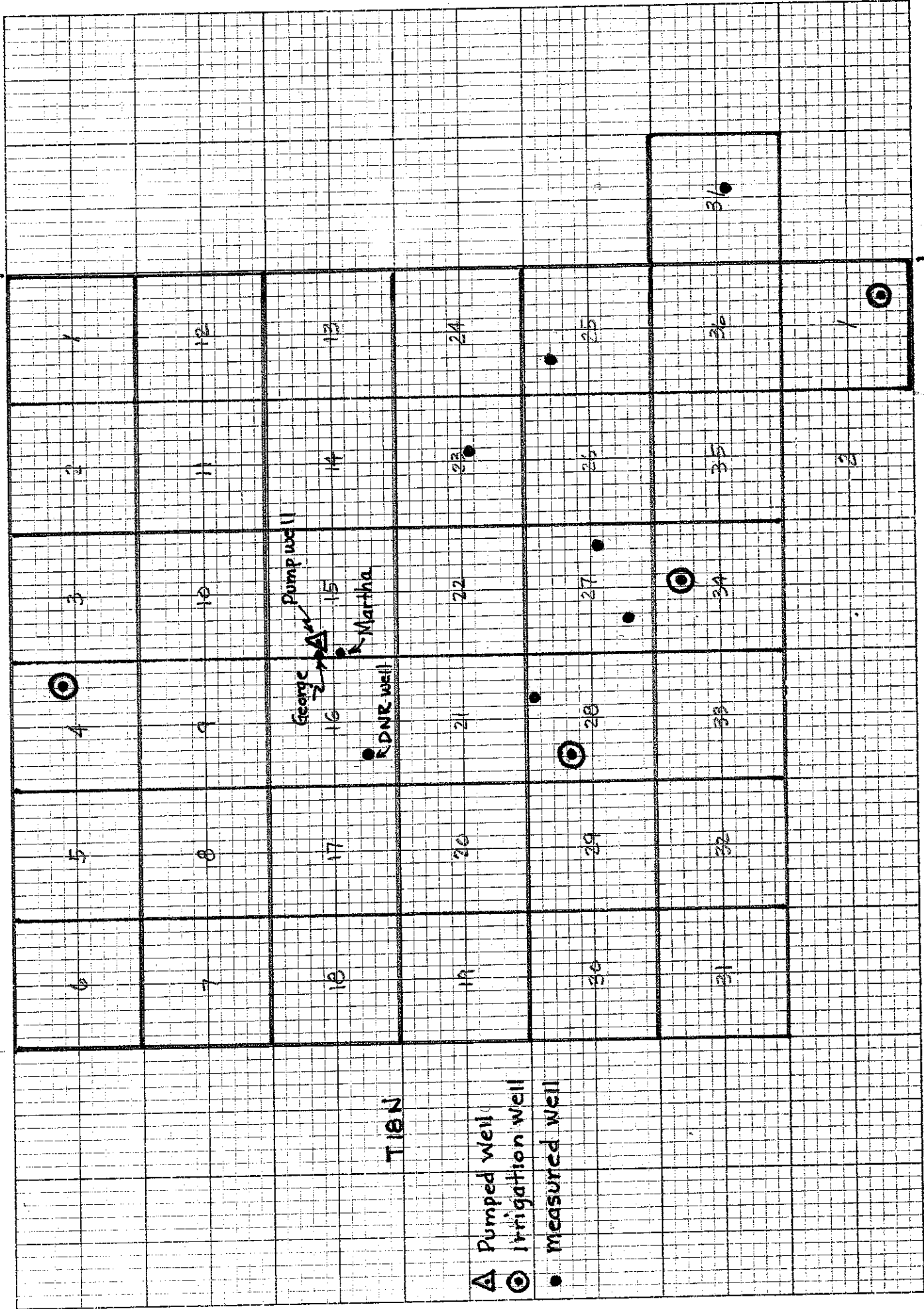
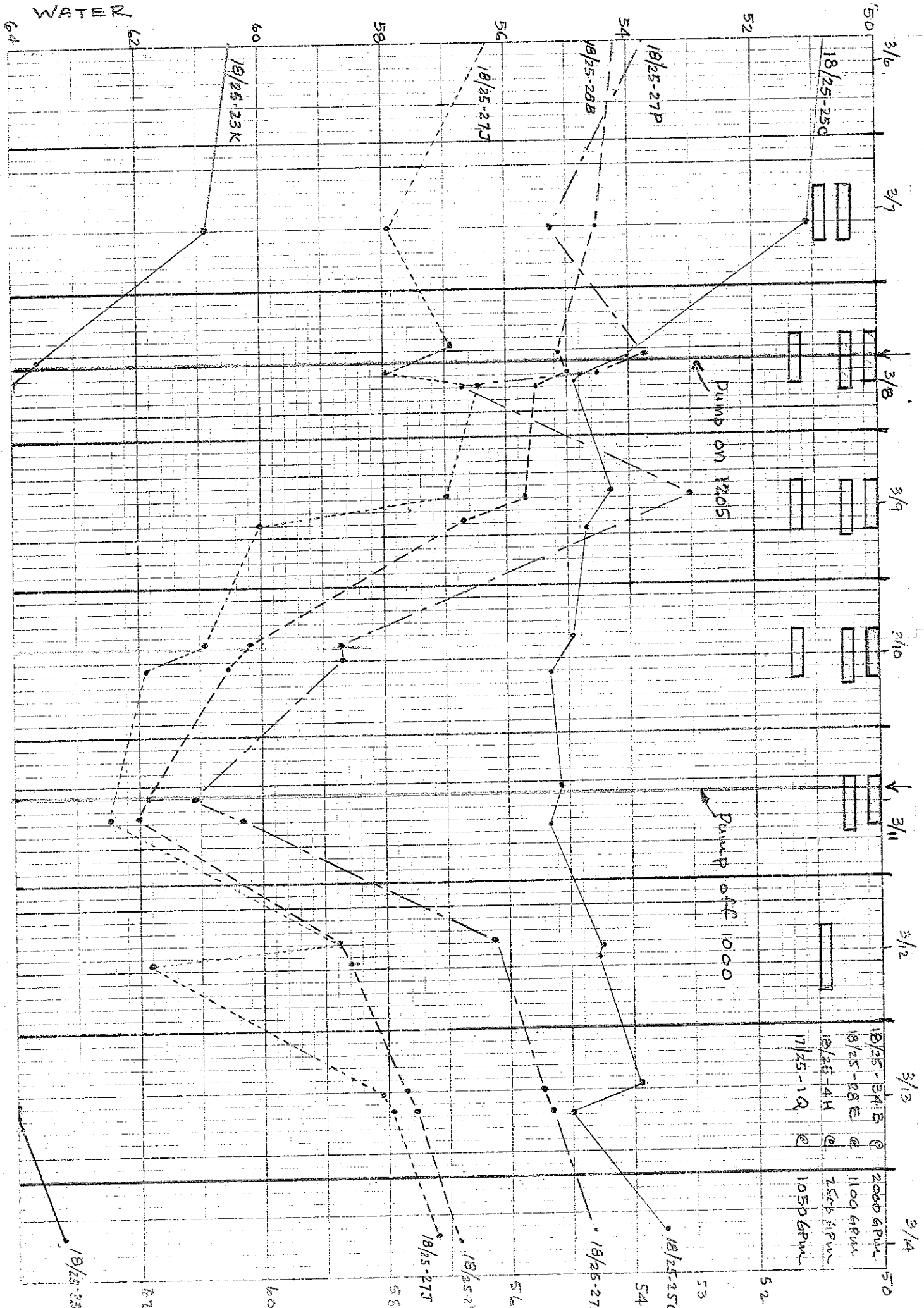
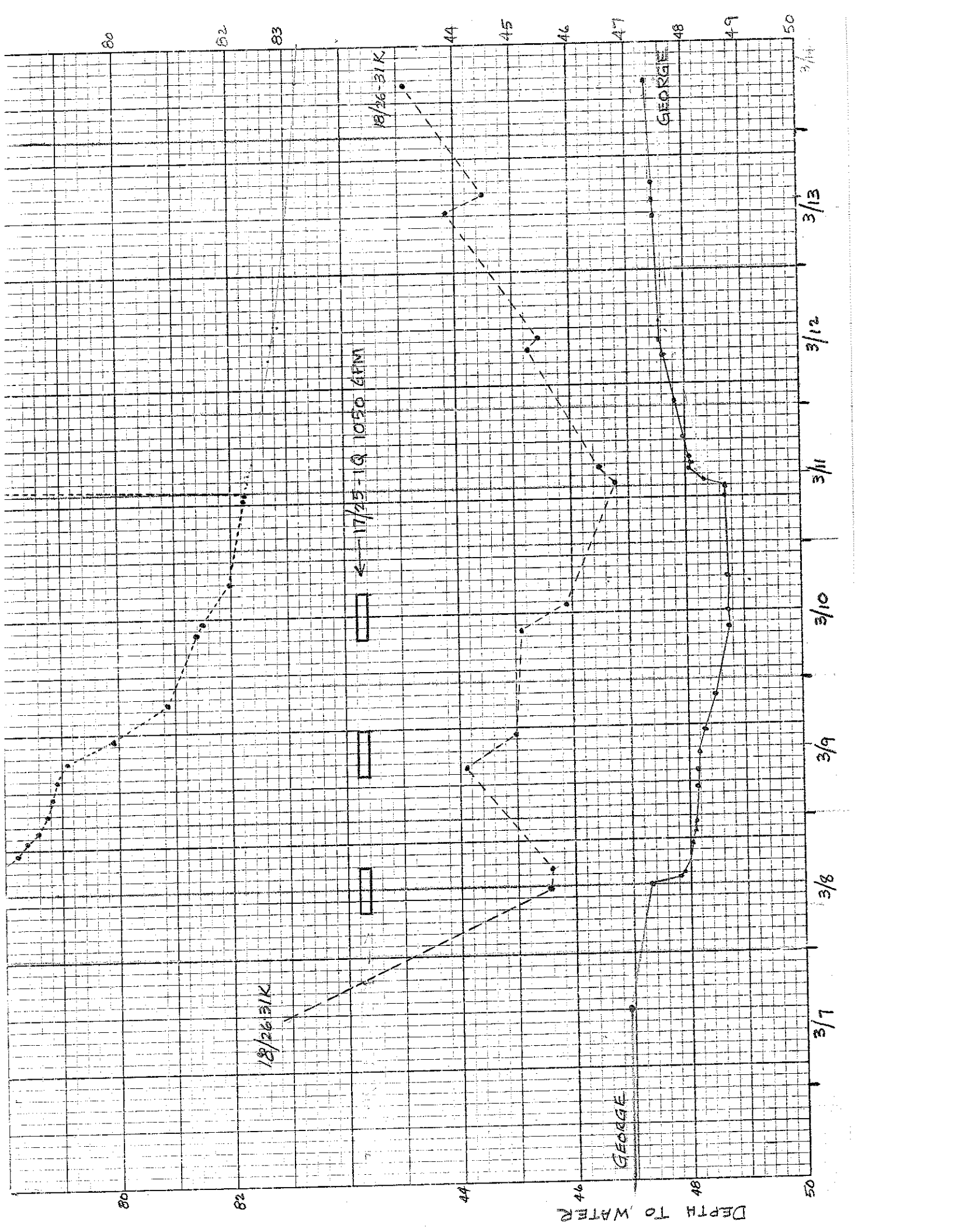
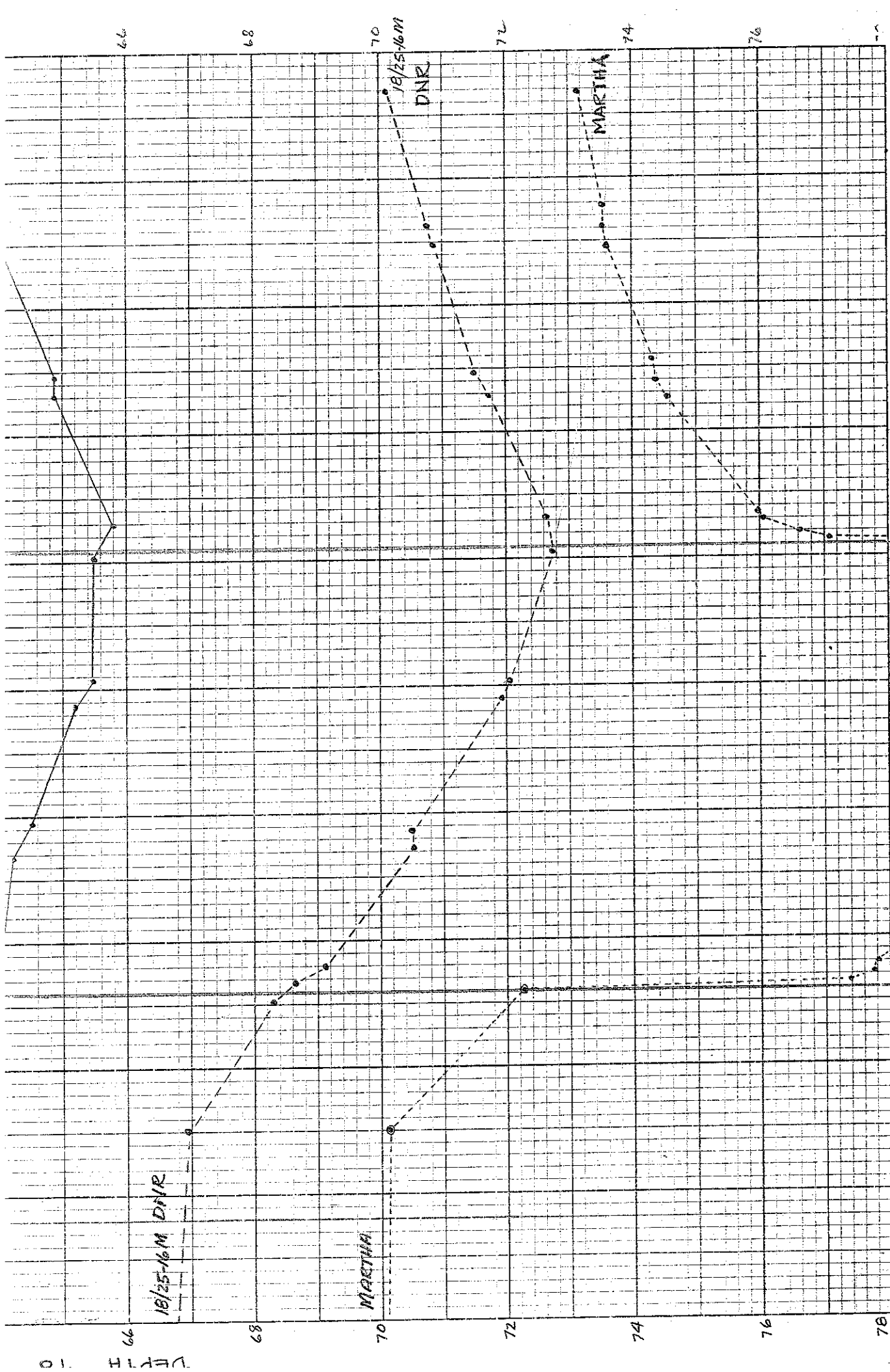


FIGURE 2.- PLAN VIEW OF WELL LOCATION

FIGURE 3. -- DEPTH TO WATER OF 9 WELLS MEASURED AND PUMP INTERVALS OF FOUR IRRIGATION WELLS.

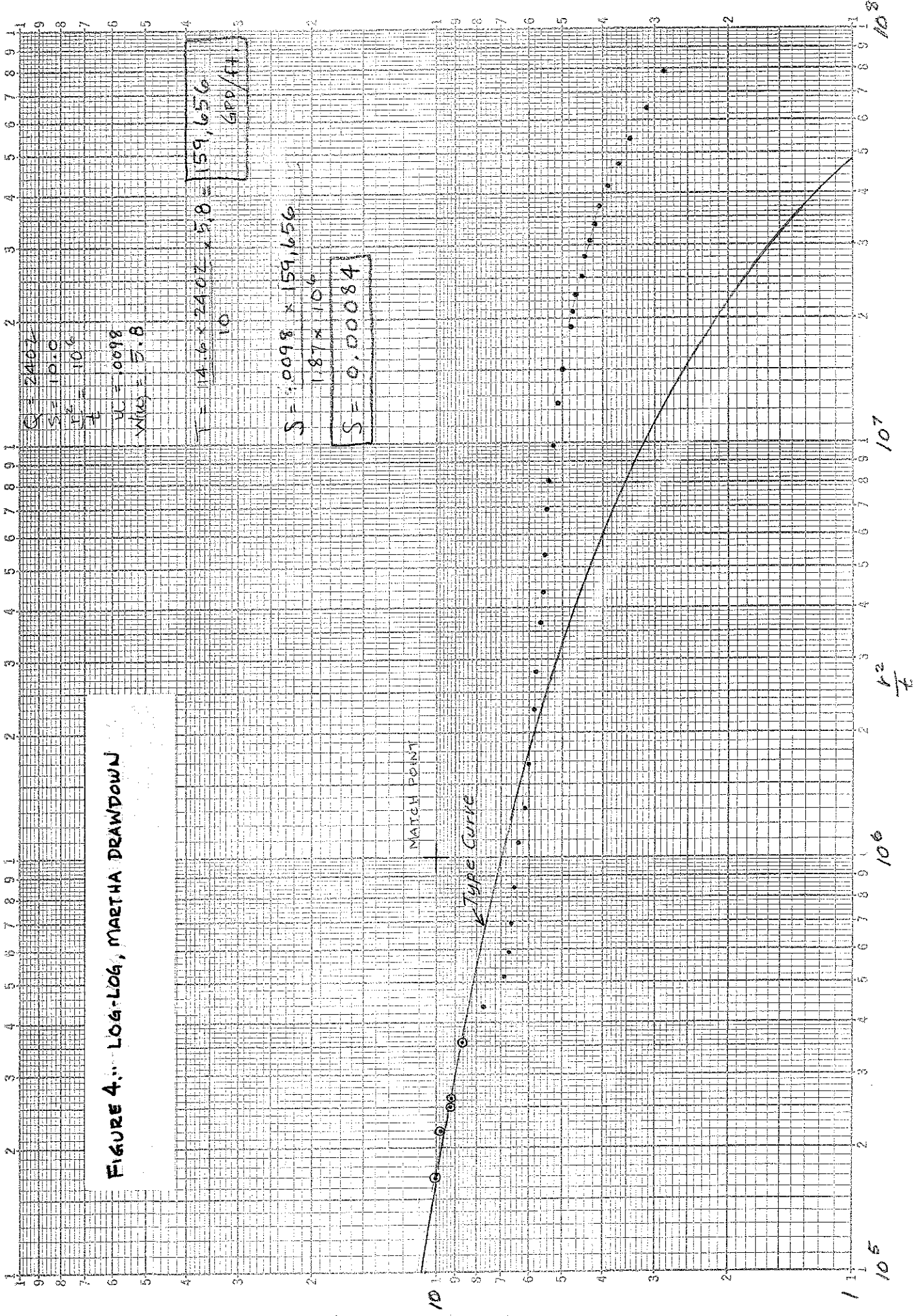








*Martha - This is non-equilibrium plot.*



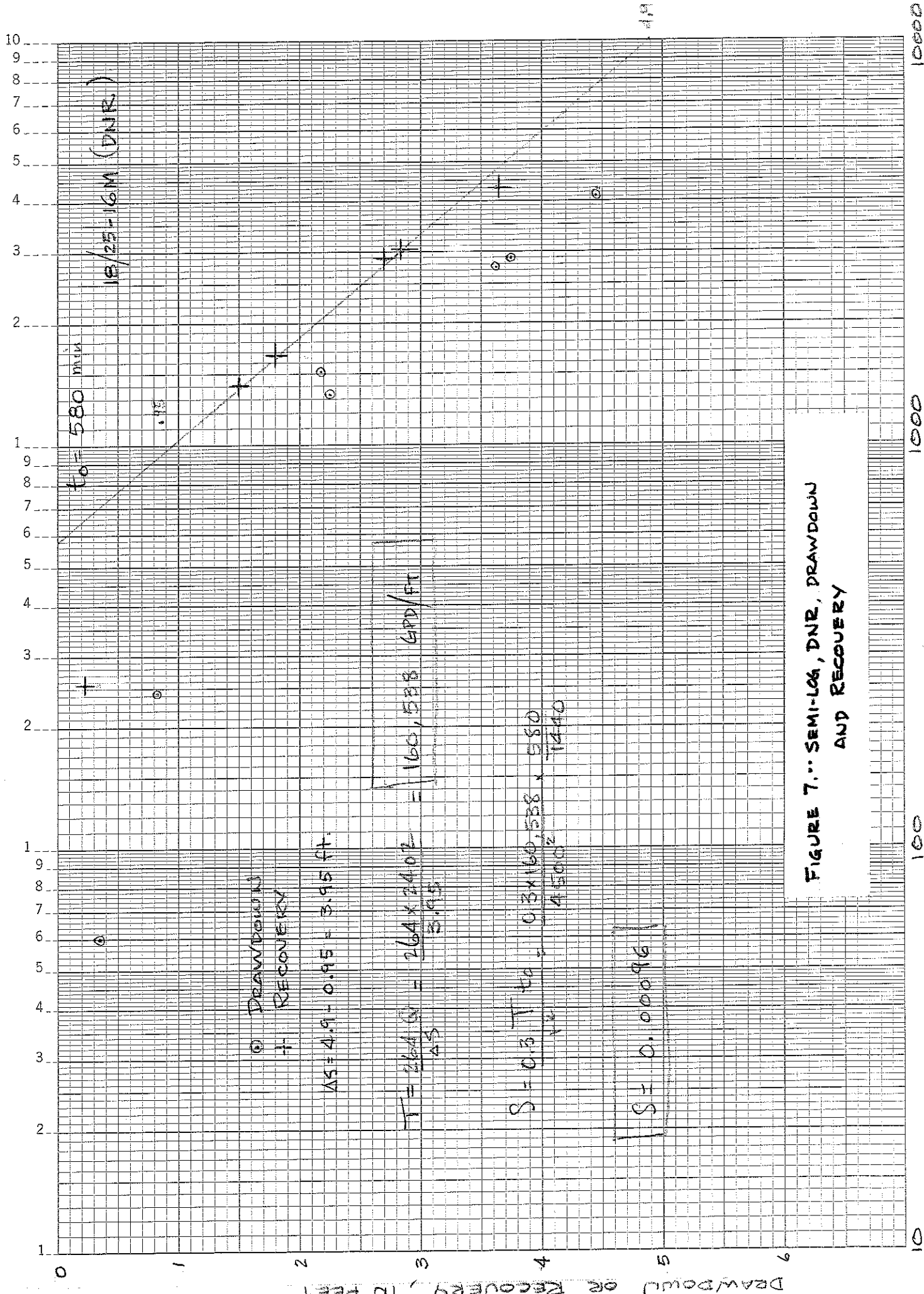
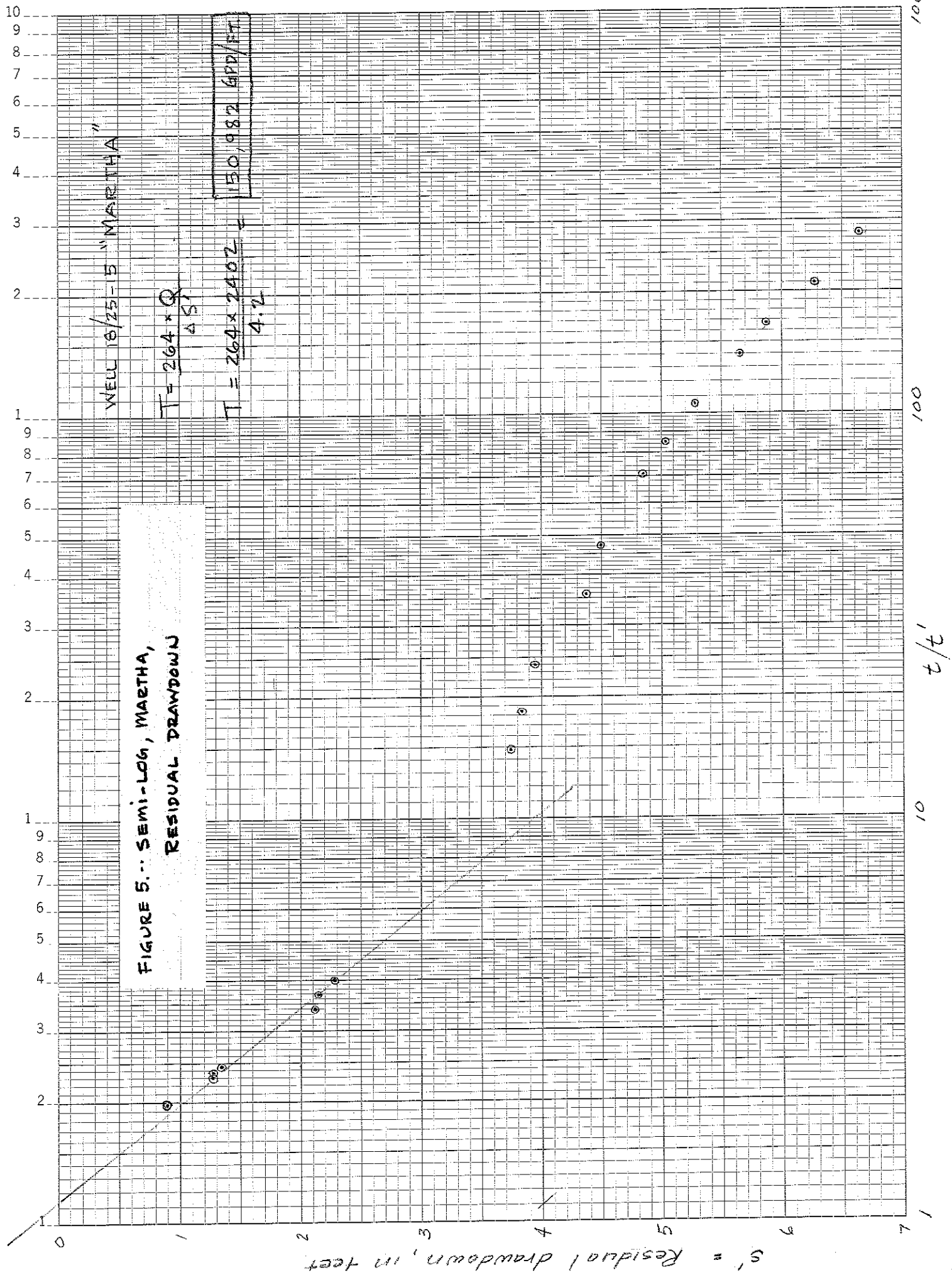


FIGURE 7. SEMI-LOG, DNR, DRAWDOWN AND RECOVERY

10  
9  
8  
7  
6  
5  
4  
3  
2  
1  
9  
8  
7  
6  
5  
4  
3  
2  
1  
9  
8  
7  
6  
5  
4  
3  
2  
1  
100  
1000  
10000

DRAWDOWN OR RECOVERY, IN FEET

TIME IN MINUTES AFTER PUMPING BEGAN OR ENDED



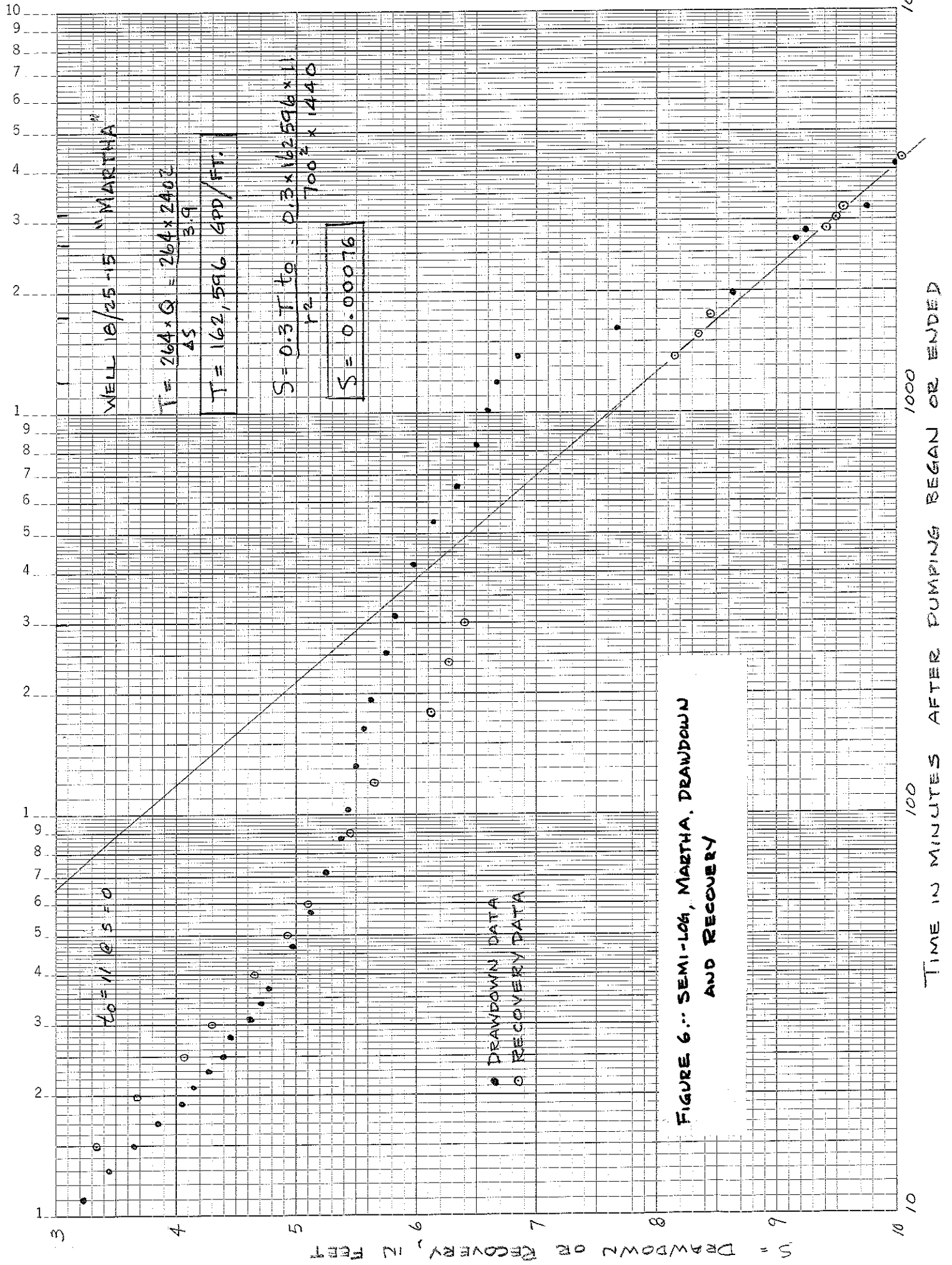


FIGURE 6.- SEMI-LOG, MARTHA, DRAWDOWN AND RECOVERY

TABLE 1.-- SPARKING METER DISCHARGE MEASUREMENT

(Meter reading @ start of test 13222 x 1000

" " " end " " 23299 x 1000

Date - hour	1st Reading (1000 Gal)	2nd Reading (1000 Gal)	Difference ( <del>1000</del> Gal)	Time interval (minutes)	G.P.M.
3/8/77 1205	13222				0
1206			3600	1	3600
1210			2400	1	2400
1230			2400	1	2400
1240	13303.0	13305.4	2400	1	2400
1247	13325.0	13327.4	2400	1	2400
1335	13438	13443	5000	2 min 6 sec	2381
1420			1000	1	2400
1515	13683	13688	5000	2 m 6 s	2381
1615	13829	13834	5000	2 m 6 s	2381
1715	13972	13977	5000	2 m 6 s	2381
1900	14220	14222.4	2400	1 m 0 s	2400
2100	14511	14516	5000	2 m 6.8 s	2366
2300	14798	14800.4	2400	1 m 0 s	2400
3/9 0200	15214	15219	5000	2 m 4.6 s	2408
0500	15630	15635	5000	2 m 5.6 s	2388
0800	16035	16040	5000	2 m 6.5 s	2371
0830	16131		2400	1 m 0 s	2400
1100	16506	16511	5000	2 m 7.2 s	2360
1500	17040	17045	5000	2 m 3 s	2439
2100	17958	17963	5000	2 m 3 s	2439
3/10 0900	19709	19714	5000	2 m 4.5 s	2410
1200	20163	20168	5000	2 m 5 s	2400
1740	20955	20960	5000	2 m 5.6 s	2388
3/11 0830	23072	23077	5000	2 m 5.4 s	2392
1000	23299	AVG Q = $\frac{23299 - 13222}{4195} \times 1000 = 2402$ GPM			

**TABLE 2.- AIRLINE MEASUREMENT OF DRAWDOWN & RECOVERY**

OWNER: U. S. Dept. of Interior LOCATION & WELL #: \_\_\_\_\_  
 ADDRESS: Bureau of Reclamation W 1/4 of Sec.15, Twns.18N, Rge.25E  
 Box 043, 550 W. Fort, Boise, Idaho 83724  
 PHONE: ( 208 ) 384 - 1392  
 TEST BY: Ray Page DATE: 3 / 8 / 77 MEASURING DEVICE: WATER TEMP:  
 PUMP BOWL: 12FKH STGS: 8 FLOW METER \_\_\_\_\_ 74° C/F  
 COLUMN ASSY: 10" X 3" X 1-15/16" COX METER X DIA. DISCHARGE PIPE INSIDE:  
 GEARHEAD: Peerless RATIO: : OTHER B of R Meter \_\_\_\_\_ INCHES  
 PUMP SETTING: 300' WELL DIA: 12" AVERAGE DISCHARGE: ENGINE RPM:  
 AIR LINE LENGTH: 300' TEST 1 2400 GPM - 1700 RPM  
 STATIC WATER LEVEL: 103.65 DATE: 3/8/77 TEST 2 \_\_\_\_\_  
 REMARKS: Water Level Measured by means of 1/4" B.S.P. Airline

DRAWDOWN TEST NO. One

TIME	t MIN	AIR GAUGE	WATER LEVEL	COX METER	ORFICE TUBE	Gallonage DISCH SAND PRESS ACCUM	REMARKS:
Noon	1	88	96.72	9-1/4		2400 GPM	START 1700 RPM
12:19	2	82#	110.58	"		"	"
12:30	3	"	"	"		"	"
12:45	4	"	"	"		"	"
1:00	5	"	"	"		"	"
1:30	6	"	"	"		"	"
2:30	7	"	"	"		"	"
3:00	8	"	"	"		"	"
3:30	9	"	"	"		"	"
4:30	10	"	"	"		"	"
5:30	11	"	"	"		"	"
7:00	12	"	"	"		"	"
8:00	14	"	"	"		"	"
9:00	16	"	"	"		"	"
10:30	18	"	"	"		"	"
11:30	20	"	"	"		"	"

**LUHDORFF**

DRAWDOWN TEST NO. \_\_\_\_\_

CONTINUATION SHEET

2

Gallonage

TIME	t MIN	AIR GAUGE	WATER LEVEL	COX METER	ORFICE TUBE	DISCH PRESS	SAND ACCUM	REMARKS :
11:50PM	25	82#	110.58	9-1/4		2400GPM		1700 RPM
3/8/77 1:00AM	30	81	112.89	"		"		"
2:50	35	"	"	"		"		"
4:00	40	"	"	"		"		"
5:50	45	"	"	"		"		"
7:00	50	"	"	9		"		"
8:50	60	"	"	"		"		"
10:00	70	"	"	"		"		"
11:50	80	"	"	"		"		"
Noon 12:15	90	"	"	"		2350		"
24 Hr 12:30	100	80	115.20	9-1/4		2400		1725
1:00	130	"	"	"		"		"
3:00	160	"	"	"		"		"
5:00	200	"	"	"		"		"
3/9/77 7:00	250	"	"	"		"		"
11:00	300	"	"	"		"		"
Midn. 12:00	350	"	"	"		"		"
36 Hr 4:00	400	"	"	"		"		"
8:00	450	"	"	"		"		"
Noon 12:00	500	"	"	"		"		"
48 Hr 4:00	600	"	"	"		"		"
8:00	700	"	"	9		"		"
Midn. 12:00	800	"	"	"		"		"
60 Hr 4:00	900	"	"	"		"		"
3/10/77 8:00	1000	"	"	"		"		"
10:00	1100	"	"	"		"		"
	1200							
	1440							

JOB NO.

BY

SUBJECT

DATE

SHEET NO.

TIME	t MINS.	t' MINS.	AIR GAUGE	WATER LEVEL	REMARKS
10:00	1	79	79	117.51	Shut Down For Recovery
10:02	2	88#		96.72	
10:04	3	"		"	
10:06	4	88.5		95.56	
10:08	5	89.0		94.41	
10:10	6	"		"	
10:15	7	89.5		93.25	
10:20	8	90.0		92.10	March 10, 1977
10:25	9	"		"	
10:30	10	"		"	
10:40	11	"		"	
10:50	12	"		"	
11:00	14	"		"	
11:30	16	"		"	
12:00	18	91.0		89.79	
	20				
	25				
	30				
	35				
	40				
	45				
	50				
	60				
	70				
	80				
	90				
	100				
	130				

Noon  
72 Hr.

89.79





AQUIFER TEST

Owner State Location 18/25-15E Well No. 13  
 Date 3/8-11/77 Meas. by HT Test \_\_\_\_\_ County Grant  
 Meas. point \_\_\_\_\_ Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment Air-pressure gage  
 DTW 0  $t_0$  \_\_\_\_\_  $Q$  \_\_\_\_\_  $r$  \_\_\_\_\_  
 Length of airline = 300 feet;  $DTW = 300 - (P.S.I. \times 2.31)$

Date	Hour	Water level		Depth (DTW)	s	t	$\frac{1440r^2}{t}$	Remarks
		<del>Head</del> P.S.I.	<del>Wet</del>					
3/8/77	1200	88		96.72				
	1219	82		110.58				
	1225	82						
	1230	82						
	1245	82						
	1335	82						
	1420	82						
	1515	82						
	1615	82						
	1715	82						
3/9	1900	82						
	2100	82						
	2300	82		110.58				
	0200	81		112.89				
	0500	80		115.20				
	0800	81		112.89				
3/10	1100	81		112.89				
	1500	81		112.89				
	2100	80		115.20				
	0900	80						
3/11	1200	80						
	1800	80		115.20				
3/11	0830	79		117.51				Pump off @ 1000, 3/11



TABLE 3-- DRAWDOWN AND RECOVERY

MEASUREMENT OF GEORGE WELL

Owner State Location 18/25-15 Well No. George  
 Date 3/8-11/77 Meas. by DW & HT Test D/D County Grant  
 Meas. point Top Cas 1.1 ft above LS Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment E-Tape  
 DTW 47.35  $t_0$  0  $Q$  2402 Gpm  $r$  60 feet

Date	Hour	Water level (ft)		Depth (DTW)	D/D s (ft)	t (min)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet					
3/8/77	1203			47.35	0	0		Pump off
	1205			47.35	0	0		Pump on @ 1205
	1206			47.48	.13	1	$5.18 \times 10^6$	
	1207			47.59	.24	2	2.59	
	1208			47.62	.27	3	1.73	
	1209			47.63	.28	4	1.30	
	1210			47.64	.29	5	1.04	
	1215			47.65	.30	10	$5.18 \times 10^5$	✓
	1220			47.67	.32	15	3.46	
	1225			47.70	.35	20	2.59	
	1230			47.65	.30	25	2.07	
	1235			47.70	.35	30	1.73	
	1245			47.80	.45	40	1.30	
	1255			47.83	.48	50	1.04	
	1330			47.88	.53	85	$6.10 \times 10^4$	
	1350			47.92	.57	105	4.94	
	1420			47.98	.63	135	3.84	
	1515			47.95	.60	190	2.73	
	1615			48.00	.65	250	2.07	
	1715			48.02	.67	310	1.67	
	1900			48.04	.69	415	1.25	
	2100			48.10	.75	535	$9.69 \times 10^3$	
3/8/77	2300			48.12	.77	655	7.91	



AQUIFER TEST

Owner State Location 18/25 -15 Well No. George  
 Date 3/8-11/77 Meas. by DW + HT Test D/D County Grant  
 Meas. point Top Lsg 1.1 ft above L.S. Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment E-Tape  
 DTW 47.35  $t_0$  0  $Q$  2402 GPM  $r$  60 feet

Date 1977	Hour	Water level		Depth (DTW)	D/D s (ft)	t (min)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet					
3/9/77	0200			48.13	.78	835	$6.21 \times 10^3$	
	0500			48.18	.83	1015	5.11	
	0800			48.17	.82	1195	4.34	
	1100			48.20	.85	1375	3.77	
	1500			48.32	.97	1615	3.21	
	2100			48.47	1.12	1975	2.62	
3/10	0900			48.75	1.40	2695	1.92	
	1200			48.70	1.35	2875	1.80	
	1800			48.75	1.40	3235	1.60	
3/11	0830			48.68	1.33	4105	1.26	
	1000			48.67	1.32	4195	$1.24 \times 10^3$	Pump off @ 1000
3/11	1001			48.62				
	1002			48.55				
	1004			48.49				
	1006			48.54				
	1008			48.48				
	1010			48.45				
	1015			48.42				
	1020			48.37				
	1025			48.37				
	1030			48.35				
	1040			48.33				





TABLE 4. DRAWDOWN AND RECOVERY  
MEASUREMENT OF MARTHA WELL

Owner State Location 18/25-15 Well No. Martha  
 Date 3/8-11/77 Meas. by D. Weis, H.T. Test D/D County Grant  
 Meas. point Top of CSG @ Land Surf. Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment E-Tape  
 DTW 72.25  $t_0$  0  $Q$  2402 Gpm  $r$  700'

Drawdown

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
3/8/77	12:04			72.25	0	0		Pump off
	12:05			72.25	0	0		Pump on
	12:06			72.55	.30	1	$7.06 \times 10^8$	
	12:07			73.22	.97	2	3.53	
	12:08			73.87	1.62	3	2.35	
	12:09			74.17	1.92	4	1.76	
	12:10			74.44	2.19	5	1.41	
	12:12			74.80	2.55	7	1.01	
	12:14			75.13	2.88	9	$7.84 \times 10^7$	
	12:16			75.47	3.22	11	6.41	✓
	12:18			75.70	3.45	13	5.43	
	12:20			75.90	3.65	15	4.70	
	12:22			76.10	3.85	17	4.15	
	12:24			76.30	4.05	19	3.71	
	12:26			76.40	4.15	21	3.36	
	12:28			76.53	4.28	23	3.07	
	12:30			76.65	4.40	25	2.82	
	12:33			76.71	4.46	28	2.52	
	12:36			76.87	4.62	31	2.28	
	12:39			76.96	4.71	34	2.08	
	12:42			77.03	4.78	37	1.91	
	12:52			77.23	4.98	47	1.50	
3/8	13:02			77.37	5.12	57	1.24	



Owner State Location 18/25-15 Well No. Martha  
 Date 3/8-11/77 Meas. by D. Weis, HAT Test D/D County Grant  
 Meas. point Top of CSG @ L.S. Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment E-Tape  
 DTW 72.25  $t_0$  0  $Q$  2402 Gpm  $r$  700'  
 Drawdown

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
3/8/77	1317			77.51	5.26	72	$9.8 \times 10^6$	
	1332			77.63	5.38	87	8.11	
	1347			77.67	5.42	102	6.92	
	1417			77.75	5.50	132	5.35	
	1447			77.82	5.57	162	4.36	
	1517			77.87	5.62	192	3.68	
	1617			78.00	5.75	252	2.80	
	1717			78.07	5.82	312	2.26	
	1905			78.23	5.98	420	1.68	
	2100			78.39	6.14	535	1.32	
3/8	2300			78.60	6.35	655	1.08	
3/9	0200			78.75	6.50	835	$8.45 \times 10^5$	
	0500			78.84	6.59	1015	6.95	
	0800			78.92	6.67	1195	5.90	
	1100			79.10	6.85	1375	5.13	
	1500			79.93	7.68	1615	4.37	
3/9	2100			80.87	8.62	1975	3.57	
3/10	0900			81.41	9.16	2695	2.62	
	1115			81.48	9.23	2830	2.49	
3/10	1800			81.99	9.74	3235	2.18	
3/11	0830			82.23	9.98	4105	1.72	
3/11	0947			82.25	10.00	4182	1.69	
3/11	(Pump off @ 1000)					4185		



Owner State Location \_\_\_\_\_ Well No. Martha.  
 Date 3/11-14/77 Meas. by \_\_\_\_\_ Test Rec. \_\_\_\_\_ County Grant  
 Meas. point \_\_\_\_\_ Elev. Meas. Point \_\_\_\_\_  
 Meas. equipment E-Tape - steel tape  
 DTW  $t_0$  \_\_\_\_\_  $t$  \_\_\_\_\_  $Q$  \_\_\_\_\_  $r$  \_\_\_\_\_  
**Recovery**

Date 1977	Hour	Water level			Recovery $s$ (feet)	$t$ (min)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
3/11	1000			82.20	0	0	Pump off @ 1000	
	1005			80.32	.12	5		
	1010			79.51	2.69	10		
	1015			78.88	3.32	15		
	1020			78.53	3.67	20		
	1025			78.13	4.07	25		
	1030			77.90	4.30	30		
	1040			77.54	4.66	40		
	1050			77.27	4.93	50		
	1100			77.10	5.10	60		
	1130			76.75	5.45	90		
	1200			76.64	5.66	120		
	1300			76.20	6.12	180		
	1400			76.08	6.27	240		
	1500			75.99	6.40	300		
3/12	0900			74.54	8.16	1380		
	1200			74.39	8.36	1560		
	1500			74.36	8.44	1740		
3/13	0930			73.59	9.41	2850		
	1230			73.53	9.49	3030		
	1530			73.53	9.55	3210		
3/14	0940			73.15	10.05	4300		





TABLE 6.- SUMMARY OF T AND S VALUES COMPUTED  
BY LOG-LOG AND SEMI-LOG METHODS

METHOD OF ANALYSIS	MARTHA		DNR	
	T (GPD/FT)	S	T (GPD/FT)	S
LOG-LOG DRAWDOWN	159,656	.00084		
SEMI-LOG RESIDUAL- DRAWDOWN	150,982			
SEMI-LOG RECOVERY	162,596	.00076	160,538	.00096

BY GWH	DATE	PROJECT	SHEET ____ OF ____
CHKD BY	DATE	FEATURE	
DETAILS APPROX. LOCATION of Wells - SEC 15 T15 R2EE			

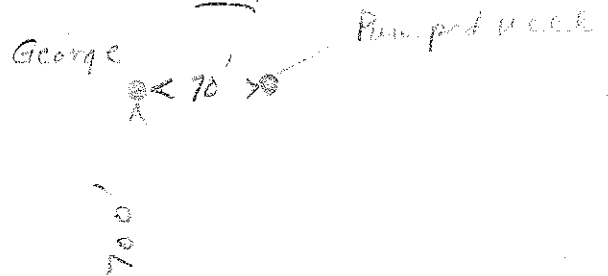
Horz & Vert. Control Needed on the following

Wells-

- shallow 18/25-15 D2 - 36.5 East of sec line (N-S) 10' south of E-W sec line.
- shallow 18/25-15 D1 - 1350' North of 1/4<sup>th</sup> 16/15 & 34.8 East of N-S sec line.
- shallow 15/25-15 E3 - 650' north of 1/4<sup>th</sup> 16/15 & 33.6 East of N-S sec line.
- shallow 18/25-15 E2 - 50' north of 1/4<sup>th</sup> 16/15 & 35.3 East of N-S sec line.
- 3" dia 373' deep - DH George - 50' north of 1/4<sup>th</sup> cor. of 16/15 & 70' East of N-S sec line.
- 18/25-15 E1 - 50' north of 1/4<sup>th</sup> cor. of 16/15 & 100' East of N-S sec line.
- Pumped well #13 18/25-15E SEC 15E. (small wood house) (Recorder house) - 50' north of 1/4<sup>th</sup> cor. of 16/15 & 35' East of N-S sec line.
- shallow 18/25-15 M1 - 50' south of 1/4<sup>th</sup> cor. of 16/15 & 30' East of N-S sec line.
- 6" - 40' deep  
4" - 157"  
3" - 840' DH - Martha - 700' south of 1/4<sup>th</sup> cor. of 16/15 & 75' East of N-S sec line.

VERT. Control Needed on the following

- 18/25-4 H
- Recorder 18/25-16 M = DNR well
- 18/25-28 B
- 18/25-23 K



Martha