03.01-04/22/93-00933

(804) 445-8637

5090
1823:LGB:srw
APR 22 1993

CERTIFIED MAIL RETURN RECEIPT REQUESTED

United States Environmental Protection Agency,
Region IV
Waste Management Division
Attn: Ms. Michelle Glenn
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Re: MCB Camp Lejeune; Hadnot Point Industrial Area-
(Site 78, Operable Unit 1)

Dear Ms. Glenn:

During a telephone conversation with EPA, and Baker Environmental, on March 15, 1993, LANTNAVFACENGCOM has gathered available information on the aquifer tests performed for the product recovery system design for Site 22 at Hadnot Point. This information has been included for EPA's review and consists of a portion of the Preliminary Engineering Report for the design.

The pumping rates for the two wells are 2 gpm and 3 gpm. The recovery well radius of influence was determined to be 300-400 feet.

It is our intent to accurately model the shallow aquifer at Hadnot Point Industrial Area to allow for an interim remedial action to be performed in accordance with the signed Record of Decision and within the time constraints established by CERCLA.

The LANTNAVFACENGCOM point of contact for this work is Ms. Linda Berry who may be reached at (804) 445-8637.

Sincerely,

L. A. BOUCHER, P.E.
Head
Installation Restoration Section
(South)
Environmental Programs Branch
Environmental Quality Division

Enclosure
Copy to:
NC DEHNR (Mr. Peter Burger)
MCB Camp Lejeune (Mr. Neal Paul, Mr. Tom Morse)
Baker Environmental (Mr. Don Joiner, Mr. Steve Kretshman)

Blind copy to:
03E
04A
405
[redacted] (2 copies w/encls)
1812
18S
LGBDoc:Phnoe90e

Preliminary
Engineering Report

Product Recovery System Design Hadnot Point Fuel Farm Marine Corps Base Camp LeJeune, NC

Contract No. N62470-88-D-5825

Naval Facilities Engineering Command
Norfolk, Virginia

January 1990

Sheet 1 of 16

SECTION 2 - FIELD INVESTIGATIONS

2.01 General

The following investigations were conducted during the field study: monitoring well installation; grain size analysis; groundwater elevation and product thickness monitoring; aquifer analysis; groundwater sampling and analysis; and an engineering survey. These investigations were required to gather information to assist in the design of a recovery system that will efficiently remove the free product that exists at the HPFF. The field investigations are detailed below.

2.02 Well Installation

The locations of the groundwater monitoring wells were based upon consideration of the hydrogeologic conditions and the assessment of petroleum leakage in the study area. The placement of the wells, as illustrated in Figure 4, was selected to provide a more precise delineation of the extent of the product plume and to assist in evaluating the aquifer conditions during the pump test of the aquifer. Five (5) 2-inch PVC monitoring wells and two (2) 6-inch PVC test/recovery wells were installed at the HPFF. The 2-inch monitoring wells were constructed of Schedule 40 flush joint threaded PVC well screen (0.020 slot) and riser to a depth of 15 feet with 10 feet of screen. The 6-inch wells were constructed of Schedule 40 PVC with the screen constructed of continuous slot wire wrapped PVC (0.020 slot size). Recovery well

#1 was installed to a depth of 34 feet while recovery well #2 was installed to a depth of 33 feet below grade. Well construction diagrams and bore logs are included as Appendix A.

All wells were installed and constructed in accordance with NAVFAC guidelines and specifications, included in Appendix B. During the drilling program, boreholes were advanced using hollow stem auger. All wells were developed following installation to remove fine-grained materials that may have entered the well during construction. This was accomplished by a combination of the continuous low yield pumping; and air-lift pumping. Equipment used for well installation was decontaminated with a high pressure steam cleaner. Fluid generated from well development and equipment decontamination was discharged to the ground.

2.03 Grain Size Analysis

Grain size analysis was conducted on five (5) samples representative of the subsurface soils. Samples were initially obtained from split spoon samples; however, the split spoon did not provide enough of a sample. The augers were spun at the depth interval for 2-5 minutes to allow representative material to reach the surface and then a sediment sample was collected. The samples were obtained from each of the product recovery wells and from monitoring well #22. Each one kilogram sample of subsurface material was shipped to McCallum Testing Laboratories, Inc., located in Chesapeake, Virignia, for sieve analysis per ASTM D-422. The results of the grain size analysis are included as Appendix C,

and will be used to specify the well screen and sand pack for the proposed recovery well during the design of the recovery system.

2.04 Groundwater Elevation and Product Thickness Monitoring

Groundwater elevations and product thickness measurements were collected from all of the HPFF monitoring wells before any work was performed at the site and upon completion of well installation. An oil/water interface probe was used to measure product thickness and groundwater elevation to the nearest 0.01 ft. These measurements, as well as measurements conducted during 1988, are summarized on Tables 2 and 3. These measurements are used in Section 3 to determine the hydraulic gradient, direction of groundwater flow, and assess the extent of free-phased product currently at the HPFF.

2.05 Aquifer Analysis

A short term pump test was performed on each of the 6-inch wells. This test was conducted to estimate design flow rates, and determine the site specific aquifer transmissivity, hydraulic conductivity, and the pumping wells radius of influence.

The test was conducted over an 8 hour period under the supervision of a hydrogeologist from O'Brien & Gere. Each well was pumped with a submersible pump at a constant rate for the duration of the test. The pumping rate was measured every 15 minutes during the aquifer testing. Water levels in the pumping and neighboring monitoring wells were recorded for the duration of the aquifer

test. Following the pump test, the residual-drawdown (recovery) rate was measured until the aquifer had reached 95% recovery.

Pump test data was tabulated and analyzed using Theis type curves, the Cooper and Jacob modification of the Theis equation, and the pump test well recovery curves. Each evaluation of the data produced a slightly different value for the various aquifer parameters. This results in a range of values being presented for each paramter (Appendix D). Using the Theis nonequilibrium well equation, a radius of influence was calculated to extend 300-400 feet after 60 days of pumping. The boundary of the radius of influence for this calculation is defined at a 0.1 foot drawdown of the aquifer.

Evaluating the various coefficients that were determined using the three methods allows an estimate of aquifer characteristics for final design. For the purposes of final design the assumed aquifer characteristics are as follows:

Transmissivity:	=	500 gpd/ft
Well Yield	=	3 gpm
Saturated Thickness	=	19-22 ft
Radius of influence	=	300-400 ft

2.06 Groundwater Sampling and Analysis

Groundwater samples were collected from each of the newly installed monitoring wells on a single occasion. A total of seven (7) samples were analyzed for volatile organic compounds and lead in accordance with the procedures outlined in the sampling and analysis plan included as Appendix E. The results will be forwarded as a separate submission.

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2.07 Engineering Survey

A topographic survey was conducted at the site to establish the horizontal location and elevation of above-grade features at the site. The topographic survey included the locations of catch basins, hydrants, power poles, manholes, roadways, buildings, tanks, fencing, monitoring wells, and any other indicators of subgrade utilities. Each monitoring well had the following points surveyed: top of PVC inner casing and ground elevation.

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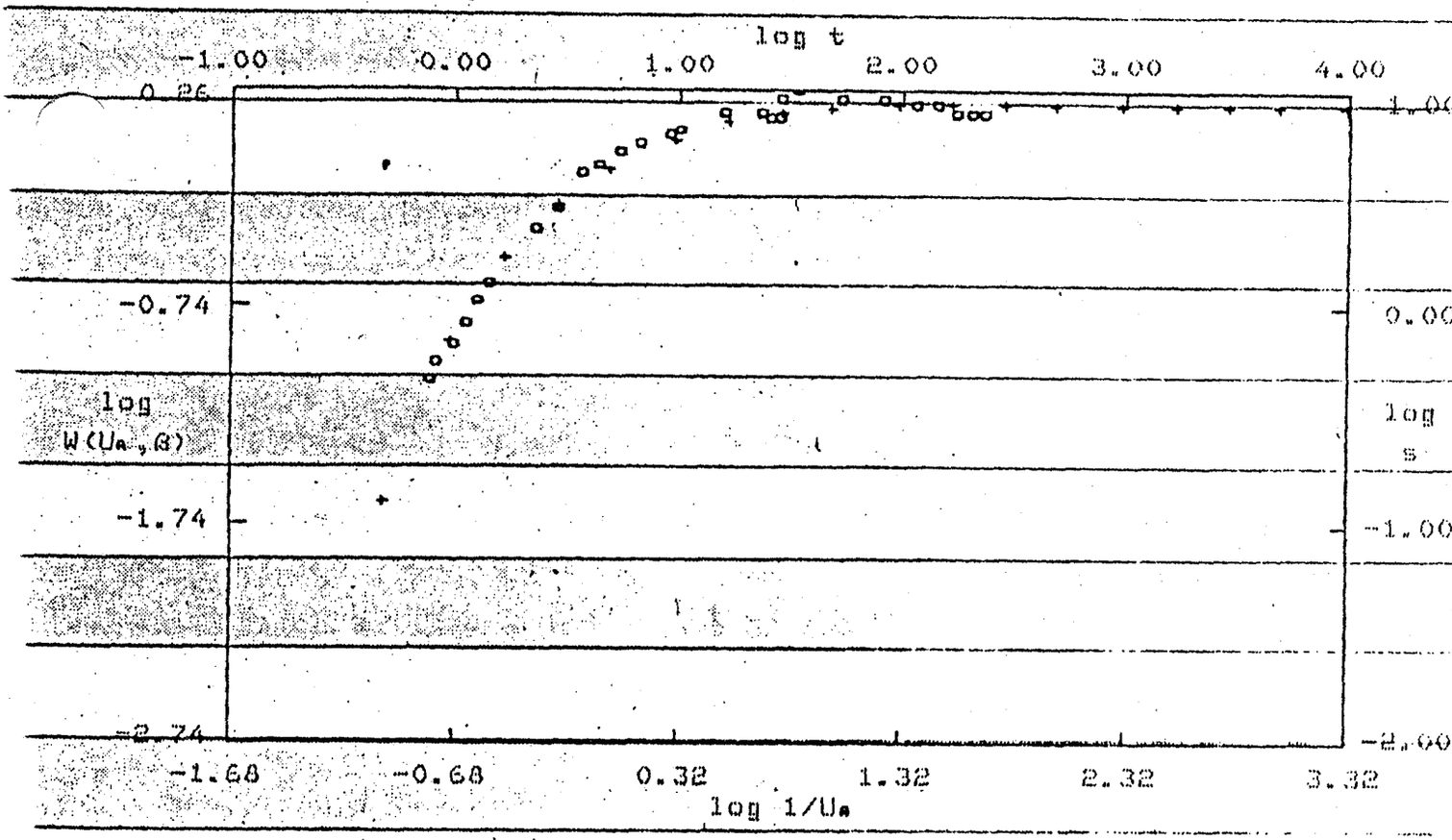
Well Name: RW#1 Date of Test: 12/15/89

Aquifer Thickness (b): 22.000 feet
Pumped Well Discharge(Q) = 3.000 gpm
Radius of Pumping Well = 0.500 feet
Distance of Observation Well from Pumping Well = 0.500 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	t / d (min./sq.ft.)
1	0.000	12.350	
2	0.780	0.450	3.12E+00
3	0.830	0.550	3.32E+00
4	0.980	0.650	3.92E+00
5	1.120	0.850	4.48E+00
6	1.250	1.050	5.00E+00
7	1.410	1.250	5.64E+00
8	2.280	2.250	9.12E+00
9	2.910	2.850	1.16E+01
10	3.670	4.150	1.47E+01
11	4.380	4.650	1.75E+01
12	5.380	5.150	2.15E+01
13	6.630	5.650	2.65E+01
14	9.083	6.420	3.63E+01
15	10.083	6.650	4.03E+01
16	15.670	7.850	6.27E+01
17	23.330	7.770	9.33E+01
18	26.000	7.550	1.04E+02
19	28.000	7.500	1.12E+02
20	29.000	8.950	1.16E+02
21	34.000	10.150	1.36E+02
22	54.000	9.150	2.16E+02
23	84.000	9.080	3.36E+02
24	114.000	8.870	4.56E+02
25	144.000	8.550	5.76E+02
26	174.000	8.060	6.96E+02
27	204.000	7.950	8.16E+02
28	234.000	7.850	9.36E+02
29	264.000	10.830	1.06E+03
30	294.000	10.810	1.18E+03
31	324.000	10.850	1.30E+03

...ation point recovery well #1



o - Data

+ - Type Curve

Unconfined Elastic: beta = 0.10

SOLUTION

Transmissivity = 6.255E+01 gal/day/ft
Aquifer Thick. = 2.200E+01 ft
Hydraulic Cond.= 2.843E+00 gal/day/sq ft
Storativity = 1.112E-01

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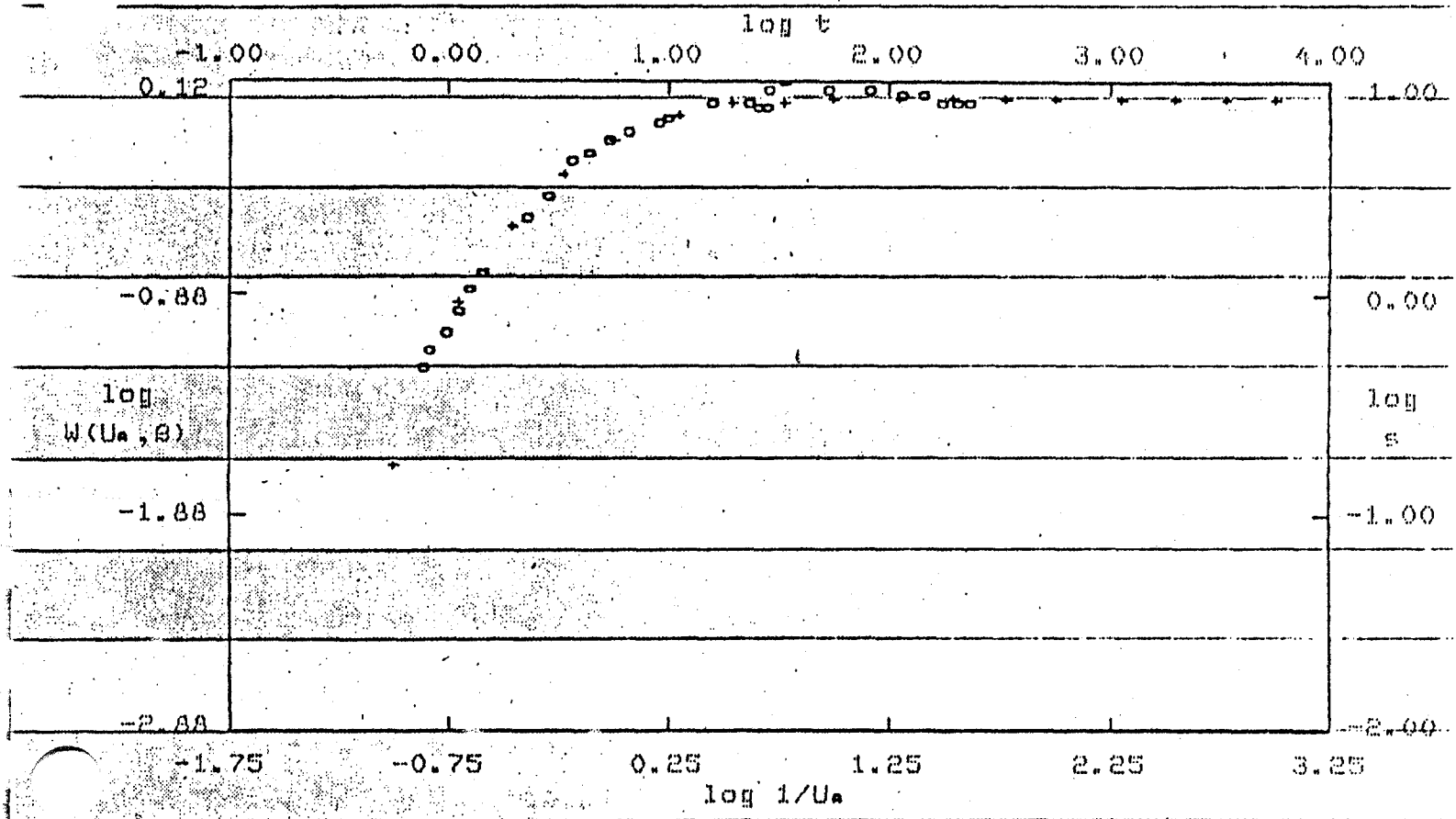
hadnot point recovery well #1



o - Data

\+ - Type Curve

Unconfined Elastic: beta = 0.20

SOLUTION

Transmissivity = 4.531E+01 gal/day/ft
Aquifer Thick. = 8.200E+01 ft
Hydraulic Cond.= 2.060E+00 gal/day/sq ft
Storativity = 9.463E-02

9/16

Data for Pump Test

Well Name: rw2 Date of Test: 12/15/89
Aquifer Thickness (b): 19.000 feet
Pumped Well Discharge(Q) = 2.000 gpm
Radius of Pumping Well = 0.500 feet
Distance of Observation Well from Pumping Well = 0.100 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	t / d^2 (min./sq.ft.)
1	0.000	14.400	
2	0.170	0.200	1.70E+01
3	0.200	0.300	2.00E+01
4	0.270	0.350	2.70E+01
5	0.350	0.400	3.50E+01
6	0.420	0.450	4.20E+01
7	0.470	0.490	4.70E+01
8	0.600	0.550	6.00E+01
9	0.830	0.700	8.30E+01
10	0.920	0.760	9.20E+01
11	1.000	0.800	1.00E+02
12	2.300	1.200	2.30E+02
13	2.570	1.400	2.57E+02
14	2.920	1.600	2.92E+02
15	3.250	1.800	3.25E+02
16	3.600	2.000	3.60E+02
17	4.270	2.200	4.27E+02
18	5.500	2.400	5.50E+02
19	5.930	2.500	5.93E+02
20	6.670	2.700	6.67E+02
21	7.670	2.900	7.67E+02
22	8.730	3.100	8.73E+02
23	9.670	3.600	9.67E+02
24	10.350	3.700	1.03E+03
25	11.000	3.900	1.10E+03
26	17.630	4.250	1.76E+03
27	19.630	4.700	1.96E+03
28	21.480	5.150	2.15E+03
29	33.930	6.100	3.39E+03
30	50.700	6.260	5.07E+03
31	65.650	6.250	6.56E+03
32	108.000	5.950	1.08E+04
33	134.000	6.750	1.34E+04
34	180.000	6.580	1.80E+04
35	240.000	6.300	2.40E+04
36	300.000	5.150	3.00E+04
37	330.000	7.430	3.30E+04
38	360.000	7.580	3.60E+04

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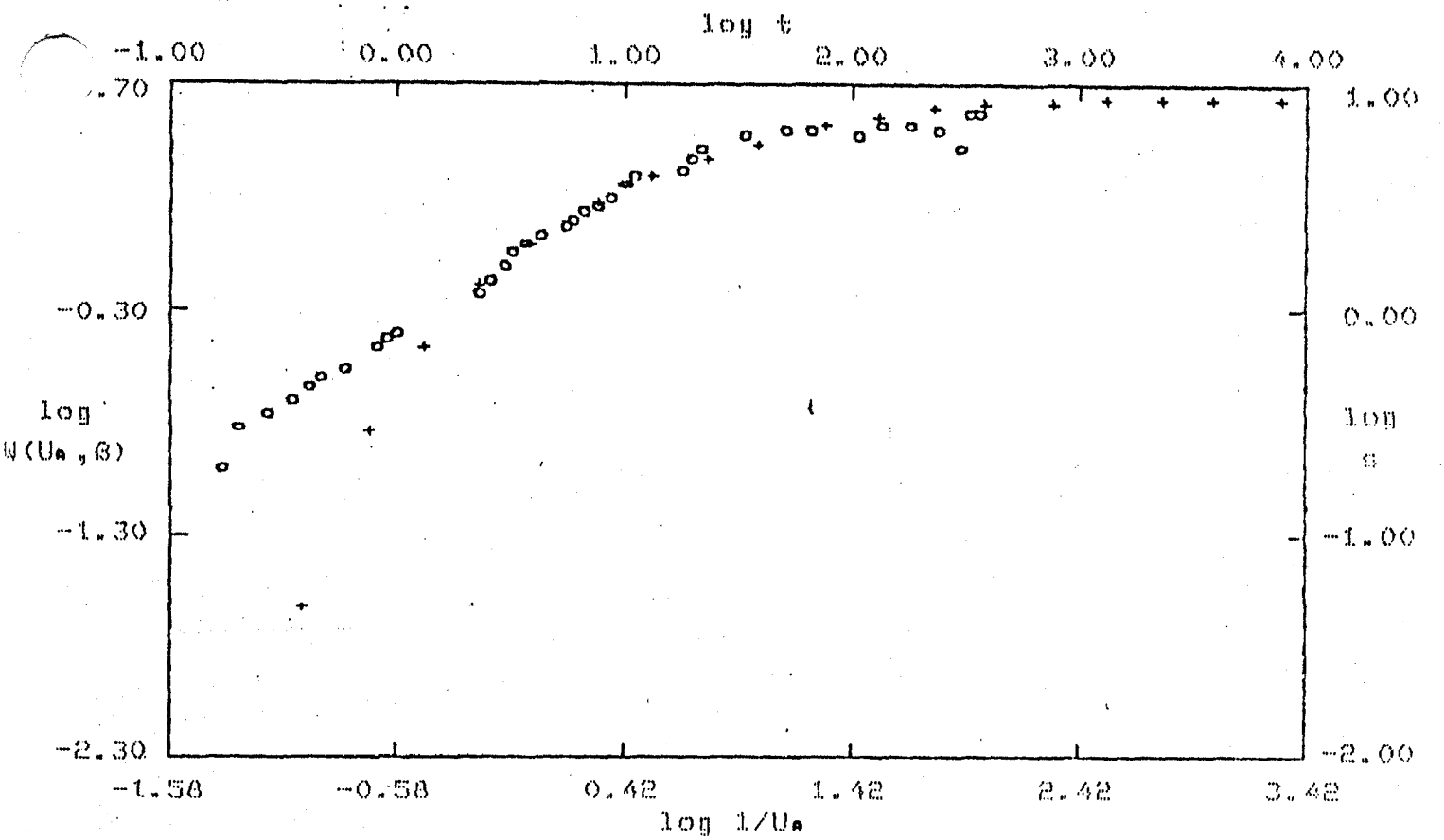
Hadnot point Well?



o - Data

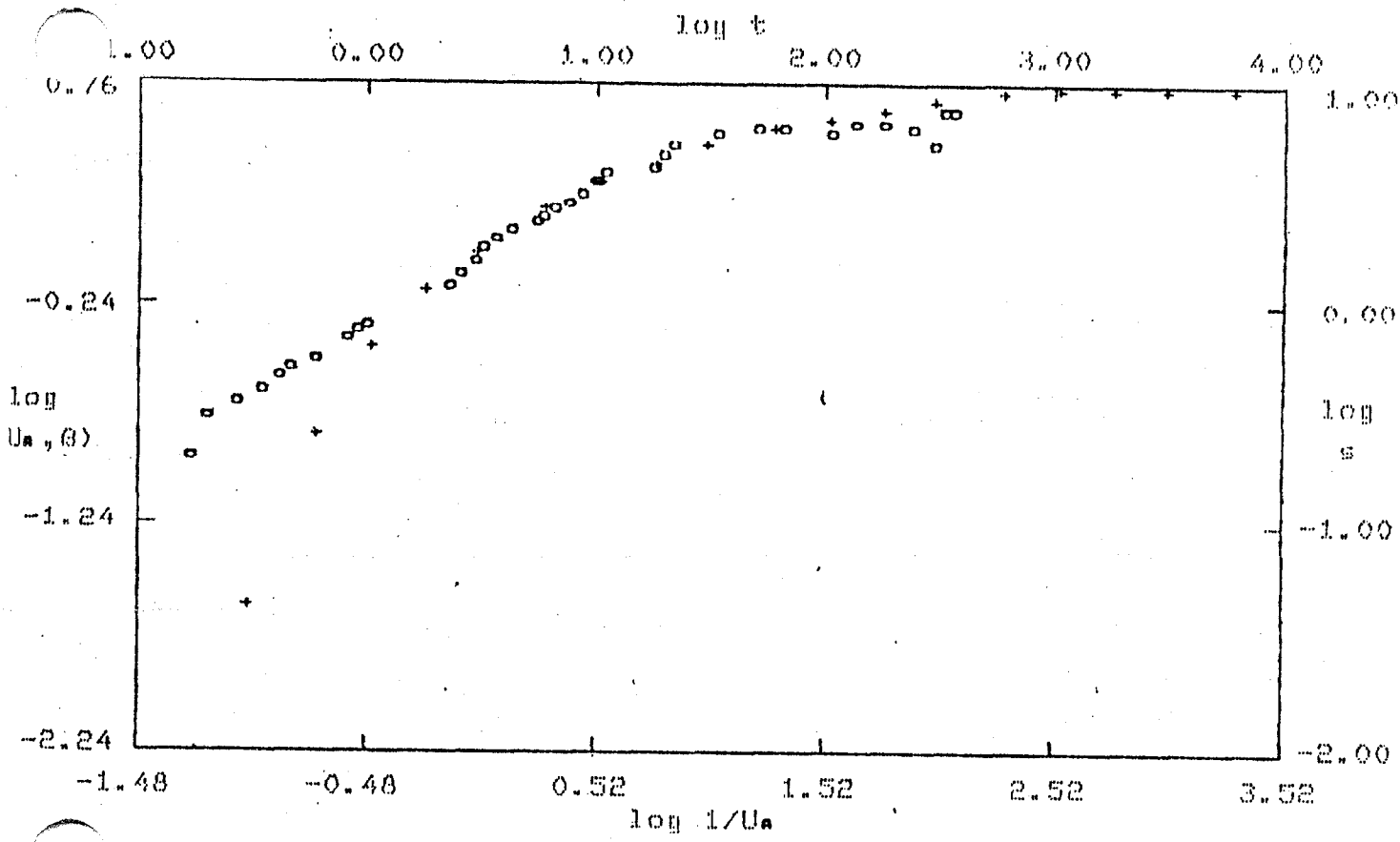
\+ - Type Curve
Unconfined Elastic: beta = 0.004

SOLUTION

Transmissivity = 1.148E+02 gal/day/ft
Aquifer Thick. = 1.900E+01 ft
Hydraulic Cond.= 6.044E+00 gal/day/sq ft
Storativity = 4.054E+00

11/16

hadnot point Rw#2



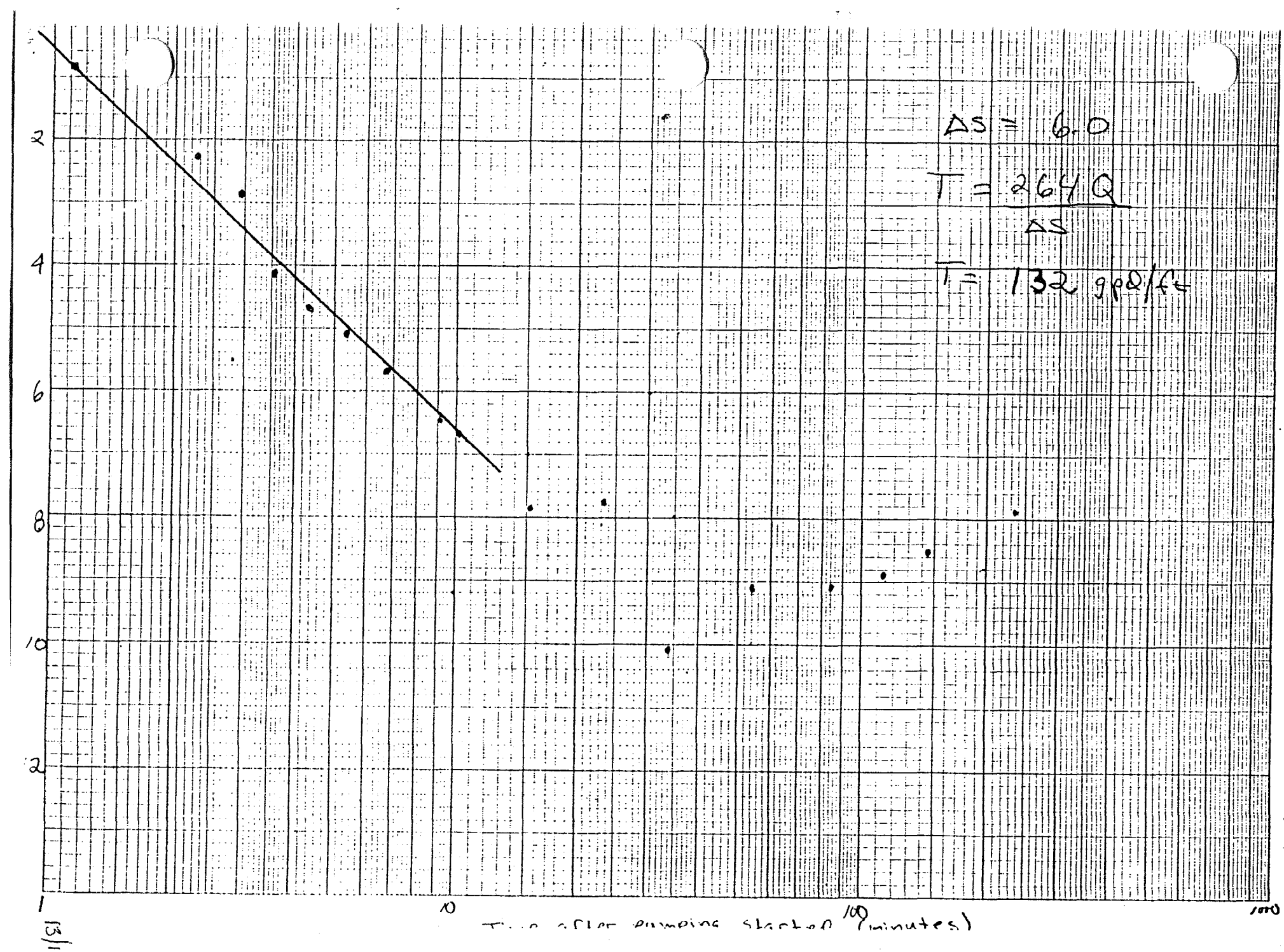
o - Data

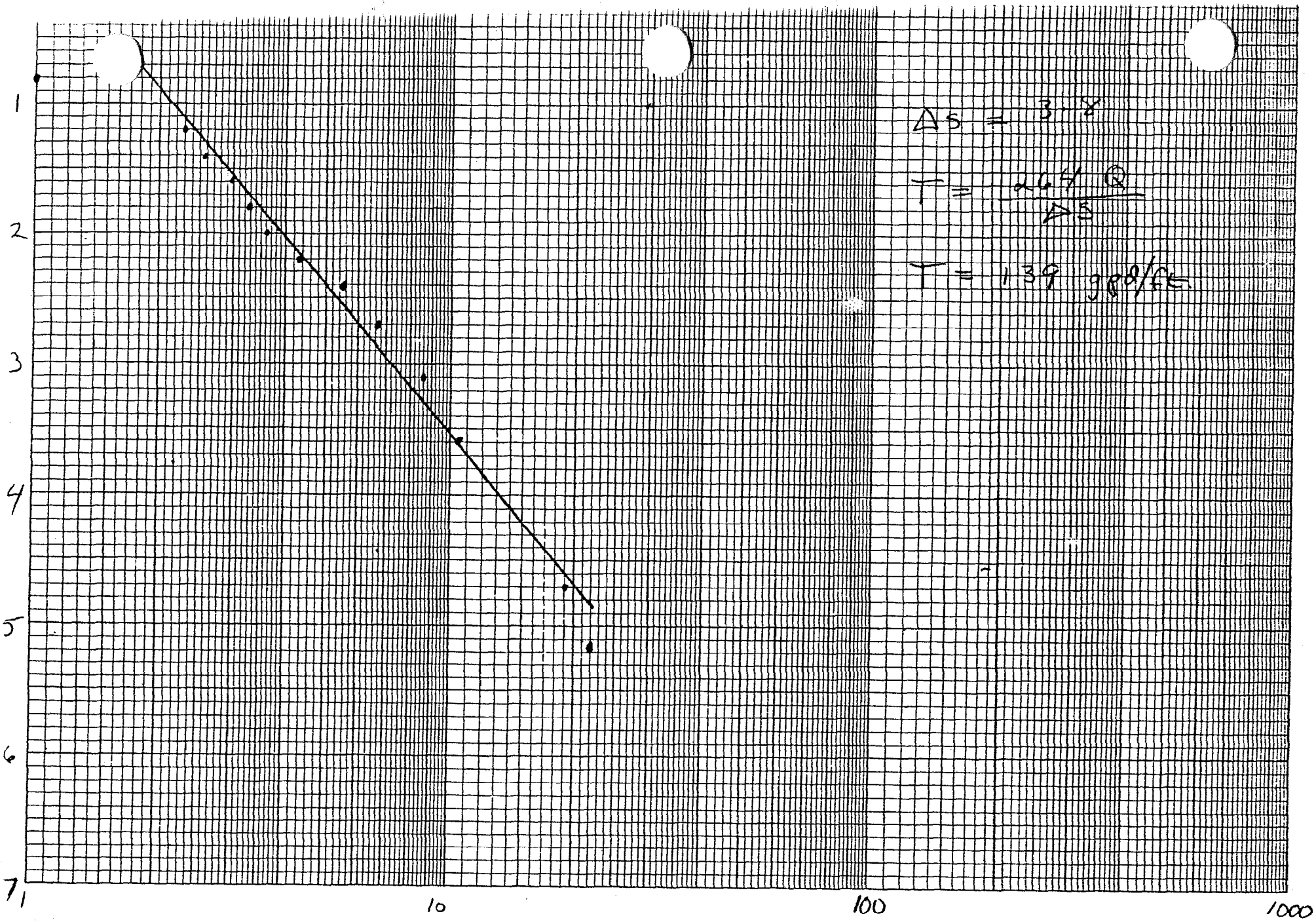
\+ - Type Curve
Unconfined Elastic: beta = 0.001

SOLUTION

Transmissivity = 1.319E+02 gal/day/ft
Aquifer Thick. = 1.900E+01 ft
Hydraulic Cond.= 6.940E+00 gal/day/sq ft
Storativity = 3.697E+00

12/16

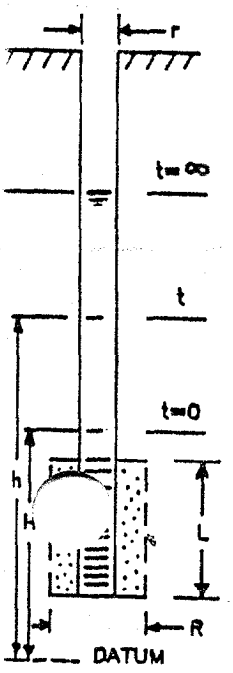

2
4
6
8
10
1
10
100
1000
Time after pumping started (minutes)
ΔS = 6.0
T = 264Q/ΔS
T = 132 gpd/ft


1
2
3
4
5
6
7
10
100
1000
Δs = 3.8
T = 264 Q / Δs
T = 139 gpd/ft.

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT 3543.002
WELL NUMBER RW61
DATE 12/15/89

LOCATION Camp Lejeune.
ELEVATION _____



STATIC HEAD (H) 12.35
PIPE RADIUS (r) .5
SCREEN RADIUS (R) 1.0
SCREEN LENGTH (L) 25.0
INITIAL HEAD (Ho) 23.3
HYDRAULIC CONDUCTIVITY :

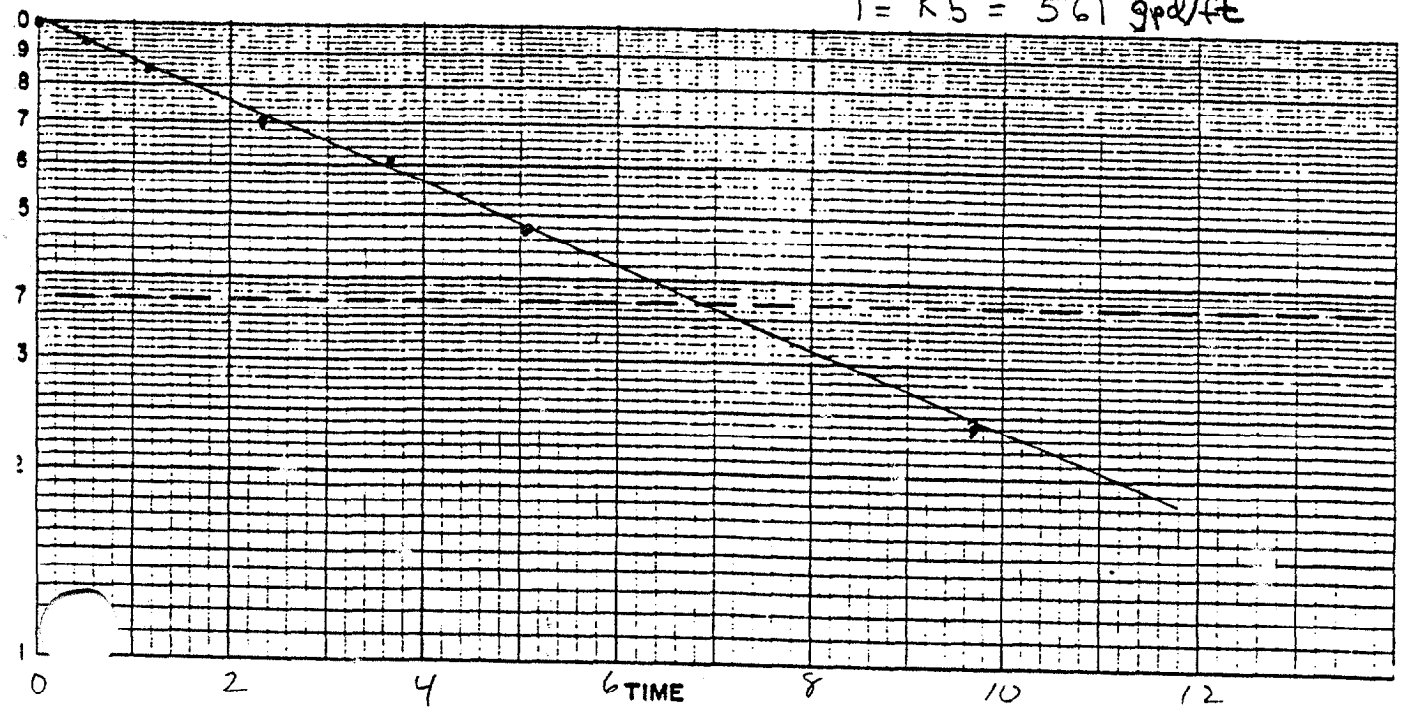
$$K = \frac{r^2 \ln(L/R)}{2LTo}$$

TIME	WATER DEPTH	t	h	H-h / H-Ho
0		0	23.3	1
28		.47	22.7	.94
1:09		1.15	21.6	.84
2:21		2.35	20.0	.70
3:39		3.65	19.0	.61
5:24		5.04	17.5	.47
9:41		9.68	15.0	.24
11:15		11.25	14.5	

10.95

$$K = \frac{(.5)^2 \ln(25/1)}{2(25)(408)} = 3.9 \times 10^{-5}\ ft/s = 25.5\ gpd/ft^2$$

$T = Kb = 561\ gpd/ft$



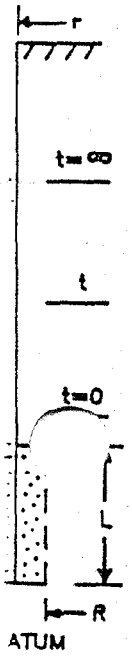
$T_o = 6.8\ min = 408\ sec$

GERE

IN-SITU PERMEABILITY TEST FIELD LOG

CT 3543-012
UMBER RW#2
12/15/89

LOCATION Camp Lejeune
ELEVATION



STATIC HEAD (H) 14.40
PIPE RADIUS (r) .5
SCREEN RADIUS (R) 1.0
SCREEN LENGTH (L) 25
INITIAL HEAD (Ho) 21.9

HYDRAULIC CONDUCTIVITY :

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

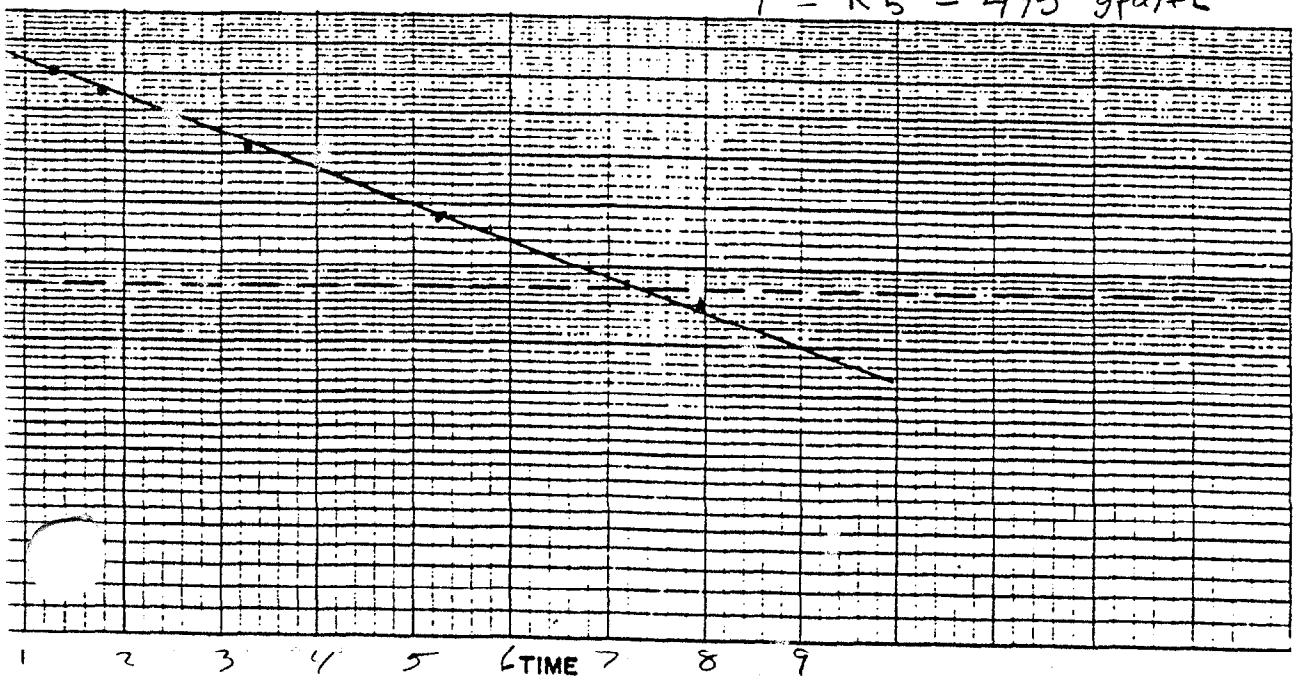
$$K = \frac{(.5)^2 \ln\left(\frac{25}{1}\right)}{2(25)(441)}$$

$= 3.65 \times 10^{-5}$ ft/s $= 23.6$ gpd/ft

$T = Kb = 495$ gpd/ft

TIME	WATER DEPTH	t	h	H−h / H−Ho
40		.67	21.0	.88
1:13		1.27	20.5	.81
1:45		1.75	20	.75
3:15		3.25	19.0	.61
5:14		5.23	18.0	.48
7:56		7.93	17.0	.35
9:58		9.97	16.0	.21

7.5



16/16