Corrected filed: 7-12-05
Corrected filed 4-6-05
Corrected filed: 12-10-04
Corrected filed: 4-16-04

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

APPLICATION FOR A MUNICIPAL AND RURAL DOMESTIC GROUND WATER TRANSFERS PERMIT

INSTRUCTIONS

For Department Use Only

Application Number: MT-6
Date Filed: March 8, 2004
Receipt Number: G25
Amount: $ 70.00

Complete items 1 through 10 by printing in ink or typing the appropriate information and by placing an (X) in the appropriate boxes.

The following information shall be provided on 8½x 11 inch paper (or folded to such size). An answer is required for each item of A-H. Each answer must be clearly identified in the application. When using a ground water model, justify the applicability to the given geologic setting.

A. Discussion of impacts on surrounding ground water and surface water supplies. Include expected radius of cone of depression and how it was determined and location of any existing wells or water rights that may be impacted.
B. Statement of impacts on any existing threatened or endangered species in project area.
C. Pump test information, if available, including length of test, data from pump test, and location of observation wells.
D. Information on geology and hydrology of area such as thickness of aquifer, depth to water, aerial extent, transmissivity and how it was determined, and whether aquifer is confined or unconfined.
E. Description of type of well, including drawings.
F. Planned operation schedule. (Describe hours per day the wells will likely be pumped, whether there will be seasonal changes to schedule, whether there will be a rotation of wells pumped, and whether certain wells are only for backup purposes.)
G. Explanation of the basis for the amount of water requested. This should include current population and projected growth, daily per capita water use data, current industrial or other large uses and projected growth. The explanation should also include answers to the requirements for approval of the application stated in § 46-642, R.R.S., 1943, as amended, namely: whether request is reasonable, not contrary to the conservation and beneficial use of ground water, and not detrimental to the public welfare.
H. Map showing location of proposed wells, pipelines (exclusive of distribution lines) and the area of proposed use. The map shall be legible and at a scale of not less than one inch to the mile.

A non-refundable filing fee (payable to the Department of Natural Resources) can be computed from the table below and must accompany this application.

QUANTITY OF WATER REQUESTED (daily average)	COST
First 5,000,000 gallons per day	$50.00
Each additional increment (or portion) of 5,000,000 gallons per day	$20.00

1. Name, address and telephone number of Applicant:

City of Sidney
1115 13th Ave, P.O. Box 79
Sidney, NE 69162 308-254-4444

Name, address and telephone number of person to contact concerning application:

Gary Person, City Manager
City of Sidney, Box 79, Sidney, NE 69162
308-254-4444 or 308-249-0900 (cell)

2. Identify the city, village, rural area or other entity to be supplied water:

City of Sidney, Nebraska and Cheyenne County SID#1

3. Maximum rate of withdrawal for which a permit is requested (complete both) 5,300 gallons per minute
7,632,000 gallons per day

Indicate whether the amount is for each well or a total rate for all wells.

app (c)

4. The daily AVERAGE amount of water requested: 3,561,640 Gallons per day

5. Total quantity of water to be withdrawn annually (gallons) 1,300,000,000 1,300,000,000 1.3 billion

6. Number of wells proposed: 0 Number of existing wells: 18

7. Location of the proposed ground water wells and existing wells:
(Indicate 40-acre government subdivision, Section, Township, Range and County, and registration number(s) if applicable):

See attachments

8. Construction will start on or before January 1, 2004.

9. Construction will be completed on or before January 13, 2004.

10. If the permit is granted, does the applicant request imposition of statutory spacing protection for one year for test holes or wells to be constructed? ☐ Yes ☒ No

If yes, indicate below the name and address of the owners and occupiers of land affected by the granting of such spacing protection, and a description of the land they own or occupy.

I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true.

Gary Person City Manager

Applicant (Signature and Title)

Original 03-14-04 Resubmitted 12/08/04

Date Resubmitted again 07/06/05

Forward application and fee to:

State of Nebraksa
Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676
(402)471-2363

STREAM DEPLETION FACTOR ANALYSIS
NORTHWEST WELL FIELD
CITY OF SIDNEY, NEBRASKA

Steam Depletion Factor (SDF) is defined as the time necessary for a continuously pumped well to deplete a stream by a specified percentage of the volume of water pumped. The COHYST Study based ground water depletion to streams on the Missouri Basin State Association hydrologic studies which used the Glover Equation. The Glover Equation indicates that a well is hydrologically connected to a stream if there was reduction in stream flow in response to 40 years of continuous pumping (SDF = 1). In other words, for 100 gallons per minute of continuous pumping, the stream would be deprived of 28 gallons per minute.

GLOVER EQUATION

$$SDF = \frac{a^2 \times S}{T}$$

SDF = Stream Depletion Factor (Days)
a= Distance (Feet)
S = Specific Yield (25 Percent For Sand and Fine Gravel)
T = Transmissivity (Feet Squared per Day)

The Glover SDF Equation was used to estimate potential impacts on the North Platte River. As the Glover Equation is based on a perpendicular intersection of ground water flow to a stream, the direct 21 mile distance to the river was used for one set of calculations. The actual hydrologic path from the well field is the 25 mile down-gradient direction to the northeast. The North Platte Technical Report (p.38) provides a transmissivity equavalent value range of 6,700 to 13, 400 feet squared per day for the South Tablelands. For the purpose of our calculations, however, we used the slightly higher transmissivity ranges found at the well field, ranging from 8,000 to 19,000 feet squared per day. The initial calculations were made using the 28 percent/40 year criteria used in the COHYST Study and the results indicate that pumping at the North West Well Field will not impact the North Platte River at the 28 percent level from 400 to 1,500 years (median = 869 years).

COHYST ANALYSIS (28 Percent Reduction in 40 Years)

Distance (Miles)	Transmissivity (Feet Squared/Day)	SDF (Years)
21	8,000	950
21	19,000	400
25	8,000	1,500
25	19,000	625

Currently, the DNR is using the 10/50 Rule to establish hydraulic connectivity between pumping wells and a surface stream. The 10 percent/50 year Rule has the net effect on the Glover Equation of reducing the SDF to 0.4 which increases the minimum distance to establish stream connectivity. The 10/50 Rule calculations were made using the same distance and hydraulic parameters as in the 28/40 analysis.

10/50 RULE ANALYSIS (10 Percent Reduction in 50 Years)

Distance (Miles)	Transmissivity (Feet Squared/Day)	SDF (Years)
21	8,000	420
21	19,000	175
25	8,000	600
25	19,000	250

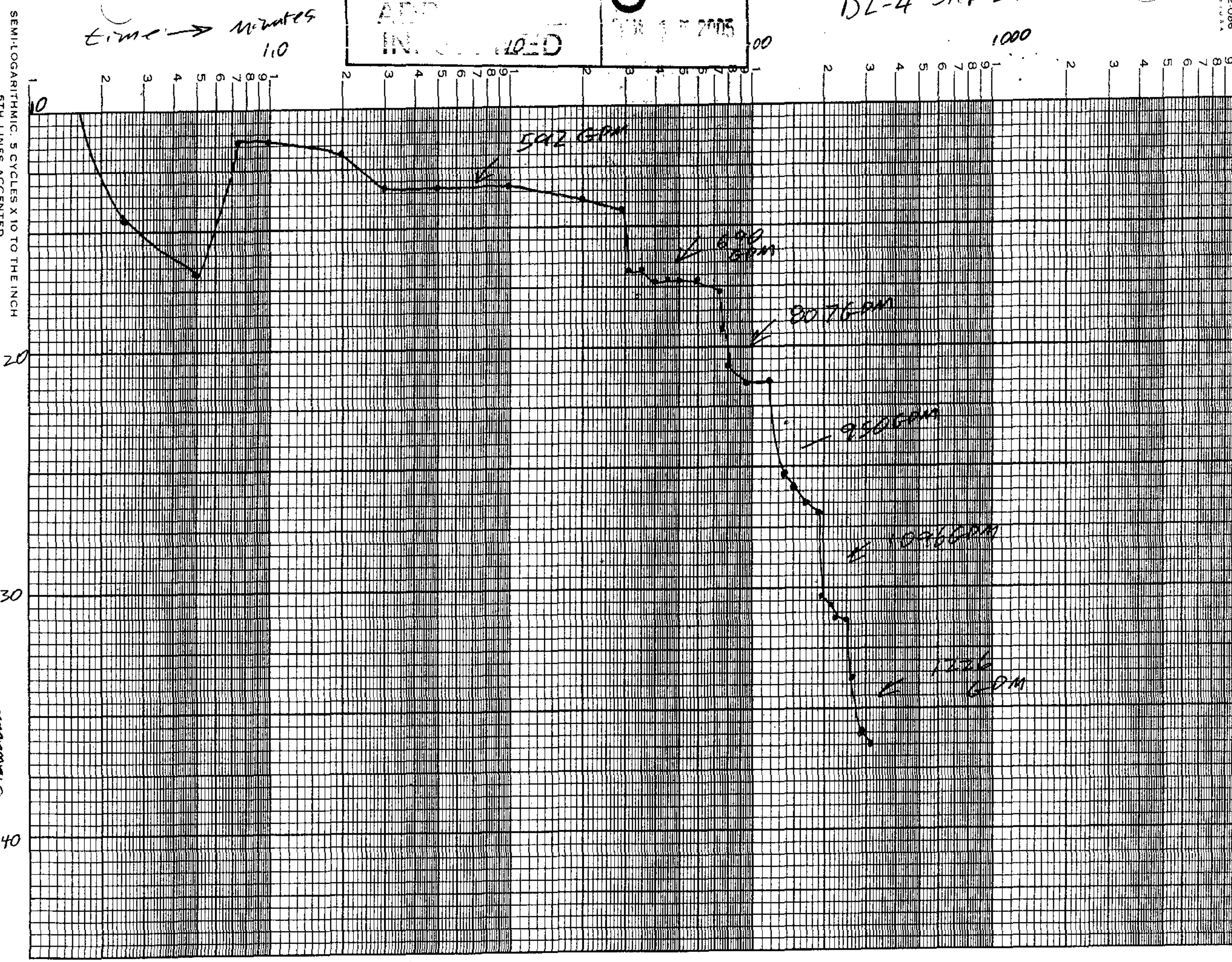
The calculations made using the 10 percent/50 year criteria indicate that pumping at the North West Well Field will not impact the North Platte River at the 10 percent level until 175 to 600 years of continuous pumping (median = 360 years). In all cases, using the 10/50 Rule, pumping at the Sidney Northwest Field will not influence flow in the River within the 50 year hydraulic connectivity limit.

PUMP TEST DATA

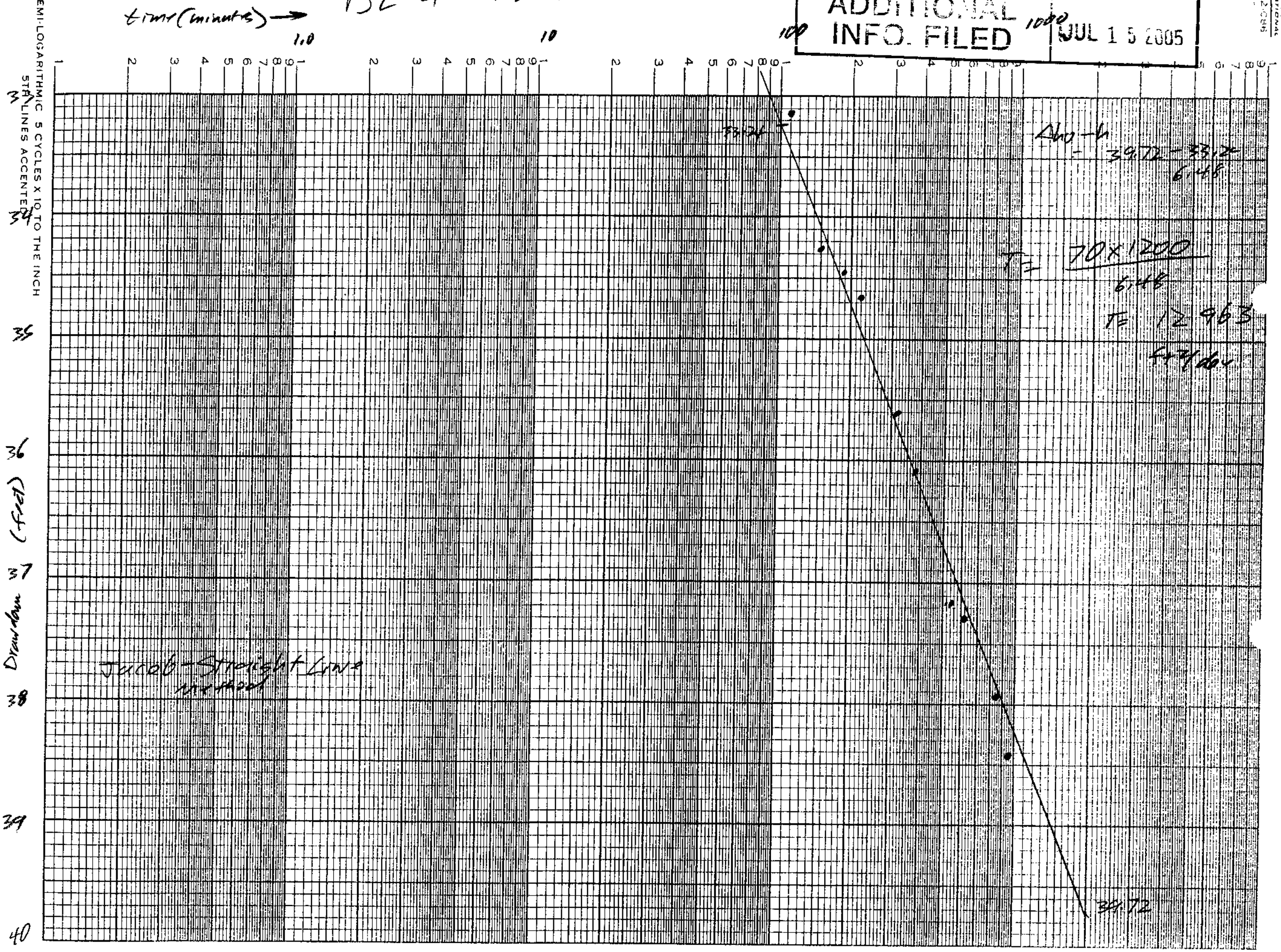
SIDNEY WELL DL-4

STEP/EFFICIENCY TEST
DL-4 PUMPING DATA
DL-4 RECOVERY DATA
DL-4 (OW) PUMPING DATA
DL-4 (OW) RECOVERY DATA
DL-5 PUMPING DATA
DL-5 RECOVERY DATA
NSL-4 PUMPING DATA
DL-4 DISTANCE-DRAWDOWN ANALYSIS

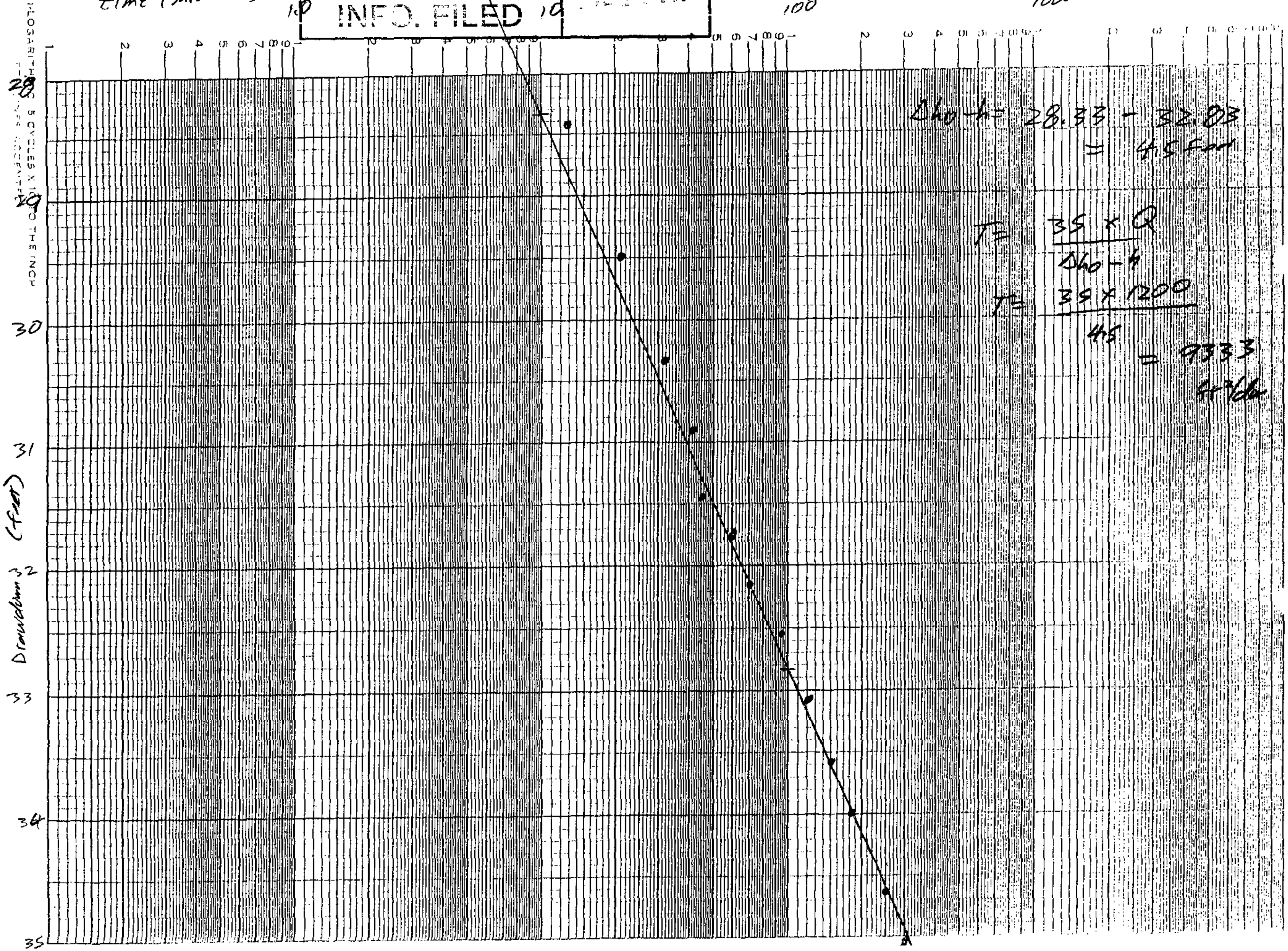
DL-4 Step-Efficiency Test



DL-4 Pumping (24-Hour)

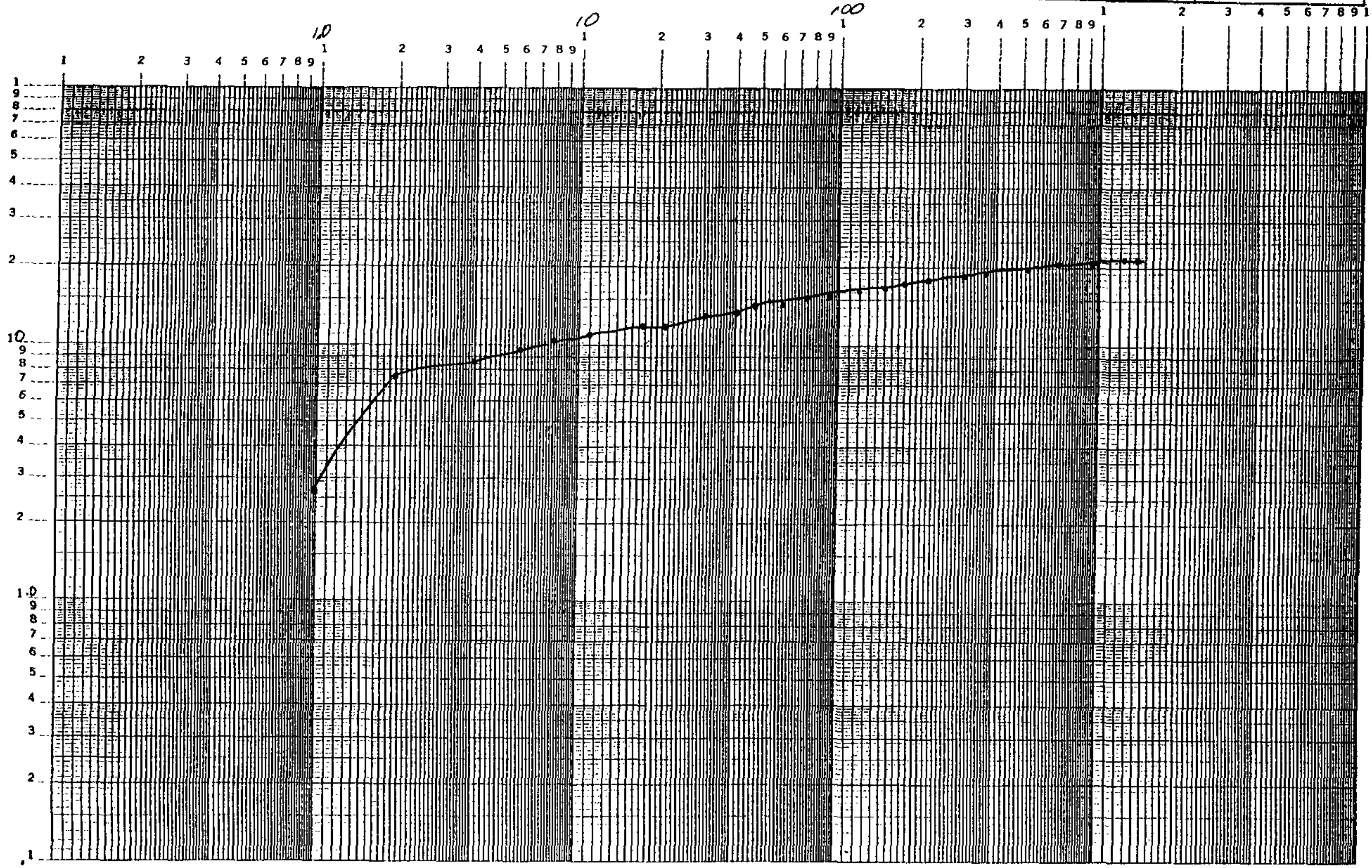


DL-4 Recovery



K+E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7520

DL-4 OW (DL-4 Pumping)



Match Point
h = 2.4 feet
t = 0.085 min

$T = \frac{15.3 \times 1200}{2.4} = 7650$ ft²/day

$S = \frac{T \Delta t\, 1}{360 (r)^2} = \frac{7650 \times 0.085 \times 1}{360 (100)^2} = 0.00018$

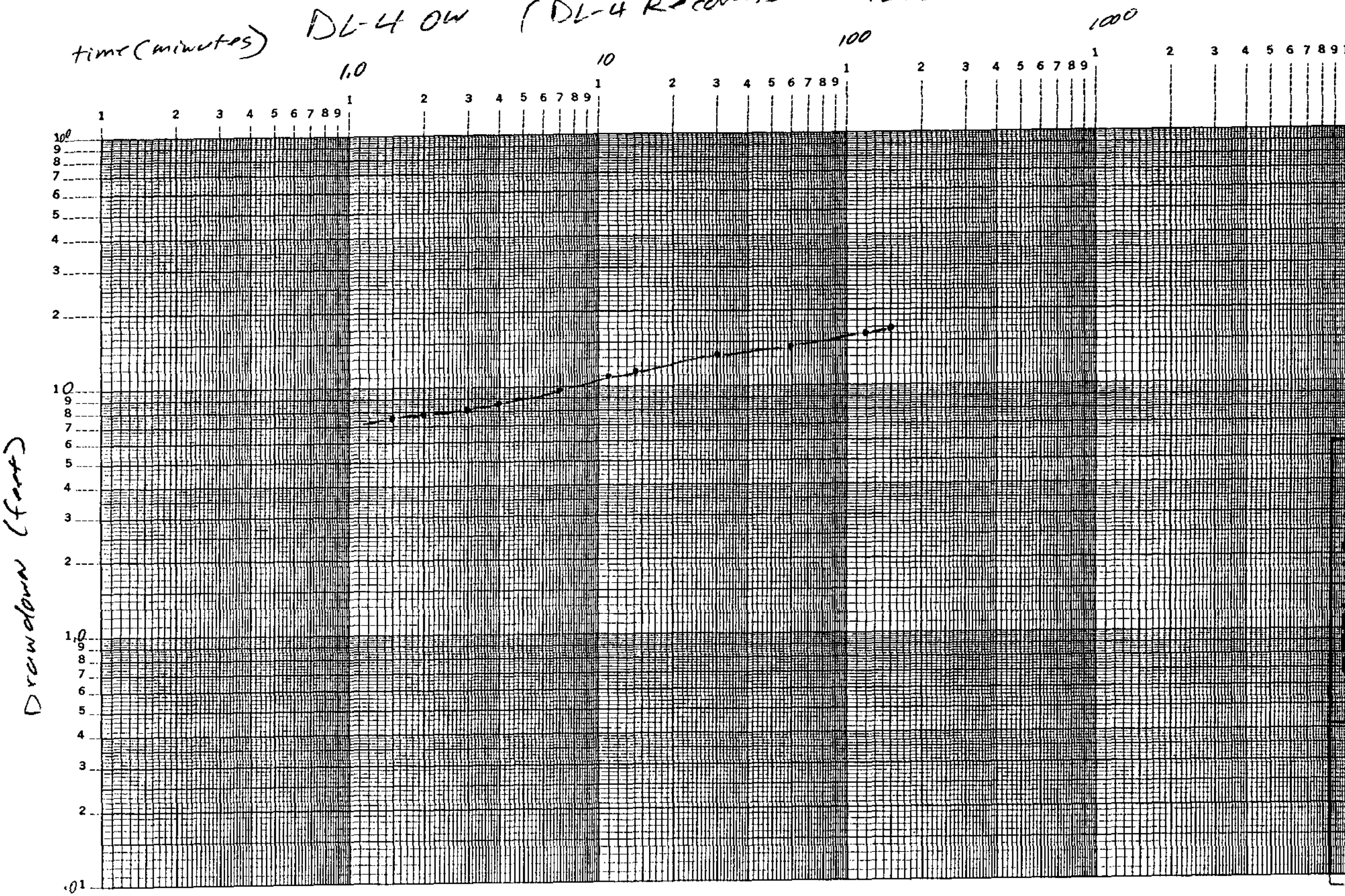
DL-4 Observation Well

DL-4 Pumping

K·E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

DL-4 OW (DL-4 Recovery) 1200 GPM



ADDITIONAL INFO FILED

$\Delta h_0 - h$ 1.85 feet

Δt 0.015 min

$$T = \frac{15.3 \times 1200 \times 1}{1.85} = 9924 \text{ ft}^2/\text{day}$$

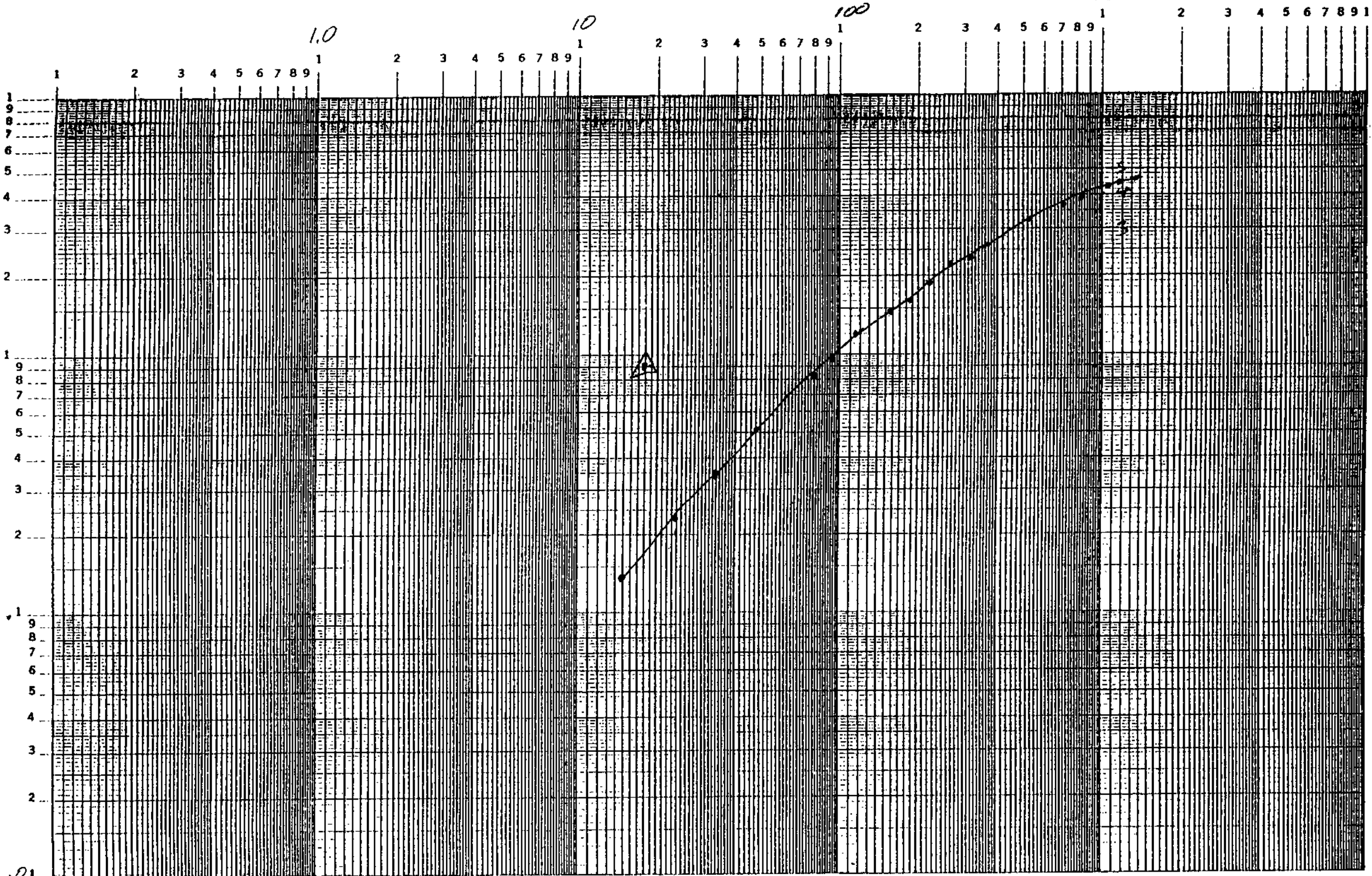
$$S = \frac{9924 \times 0.015 \times 1}{360\,(100)^2} = 0.00004$$

DL-4 observation well
DL-4 Recovery

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

time (minutes)   DL-5 (DL-4 Pump)



Drawdown (feet)

match Point
Δh=1.5 feet
t=3.8 min

$$T = \frac{15.3\,Q}{\Delta h} \quad \frac{15.3 \times 1200}{1.5} = 12240 \text{ ft}^2/\text{day}$$

$$S = \frac{T\,\Delta t\,1}{360\,(r^2)} \quad \frac{12240 \times 3.8 \times 1}{360\,(1900)^2} = 0.000036$$

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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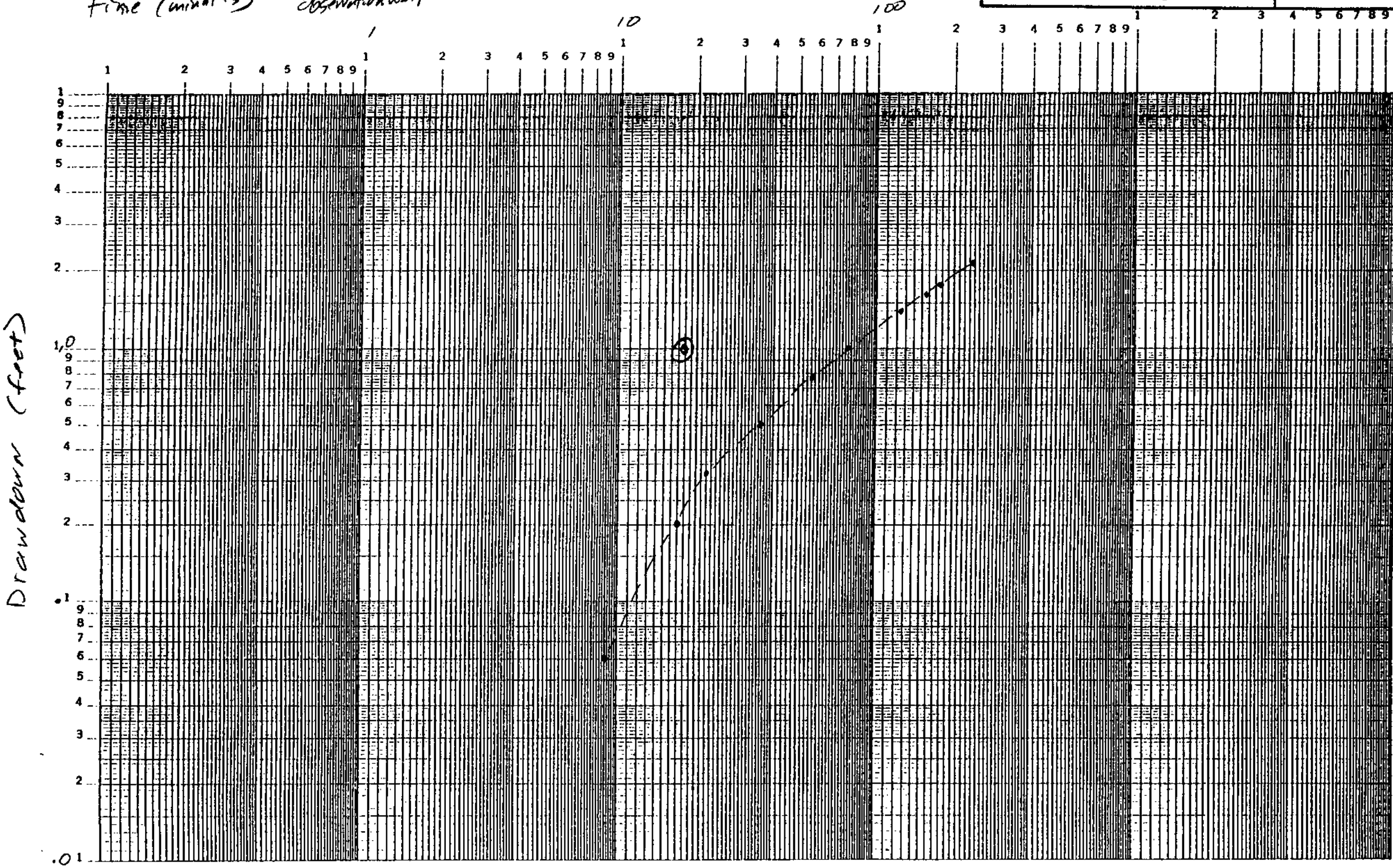
1200 GPM

INFO. FILED

DL-5 (DL-4 Recovery)

time (minutes) Observation well



Curve Match Point
Δh 1.0 feet
Δt 18 min

$$T = \frac{15.3 \times 1200}{1} = 18360 \ ft^2/day$$

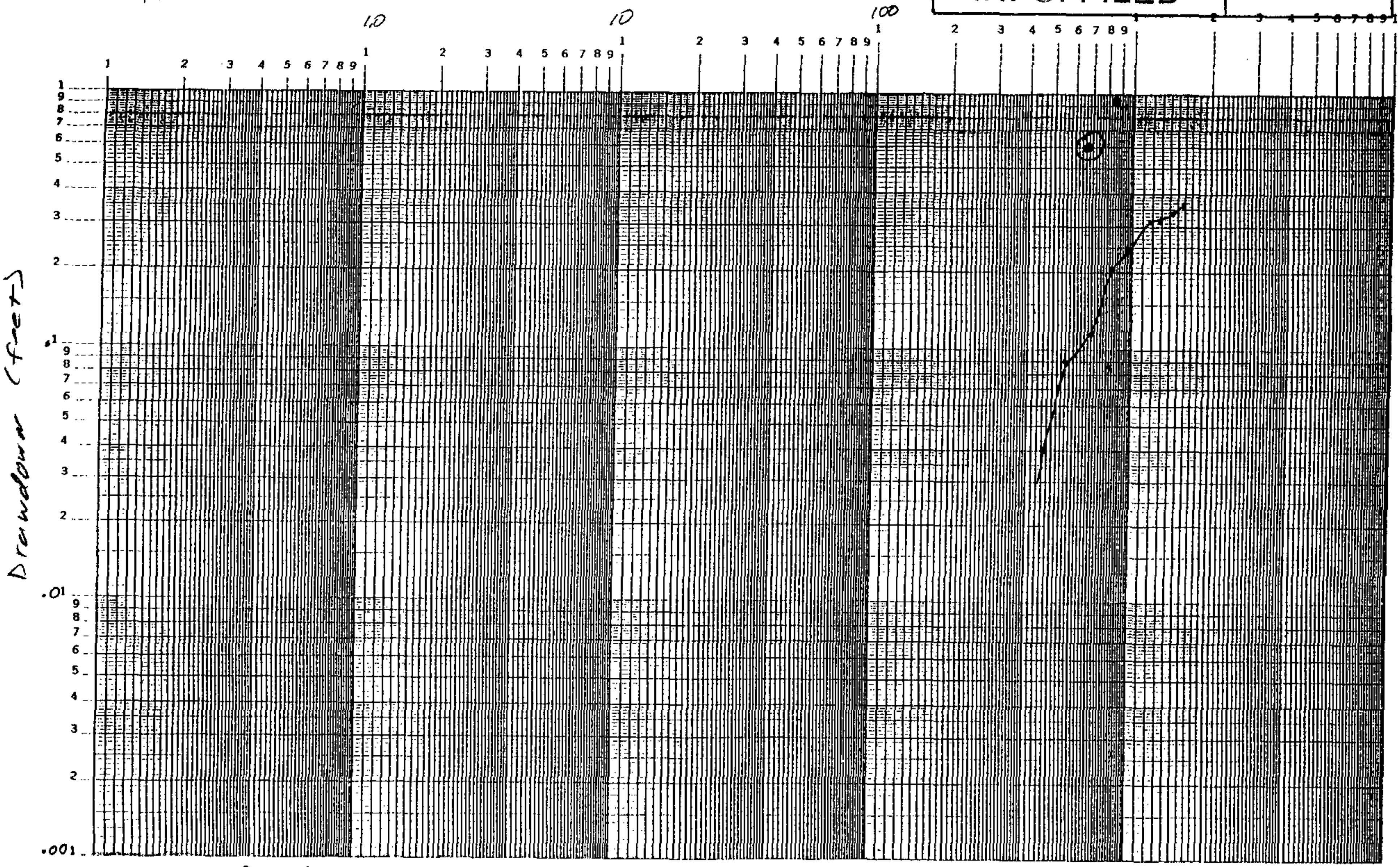
$$S = \frac{18360 \times 18 \times 1}{360 \ (1400)^2} = 0.00025$$

DL-5 Observation well
DL-4 Recovery

K•Σ LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

Observation well NSL 4
(DL-4 Pumping)



Match point
$h = 0.6$ feet
$t = 680$ min.

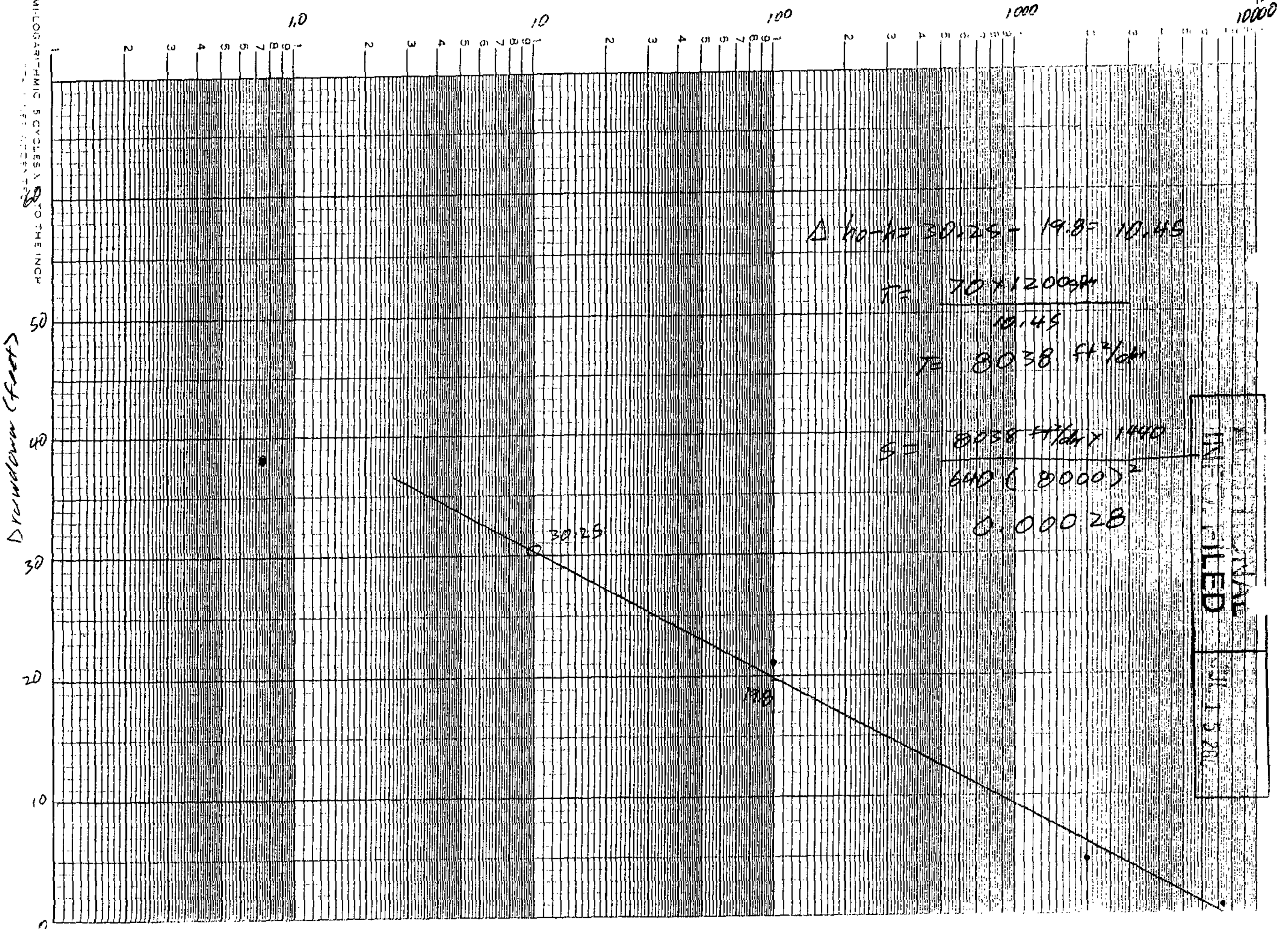
$$T = \frac{15.3\,Q}{\Delta h_0 - h} = \frac{15.3 \times 1200}{0.6} = 30600 \text{ ft}^2/\text{day}$$

$$S = \frac{30600 \times 680 \times 1}{360\,(7200)^2} = 0.0011$$

NSL-4 Observation Well
DL-4 Pumping

DL-4 Distance Drawdown

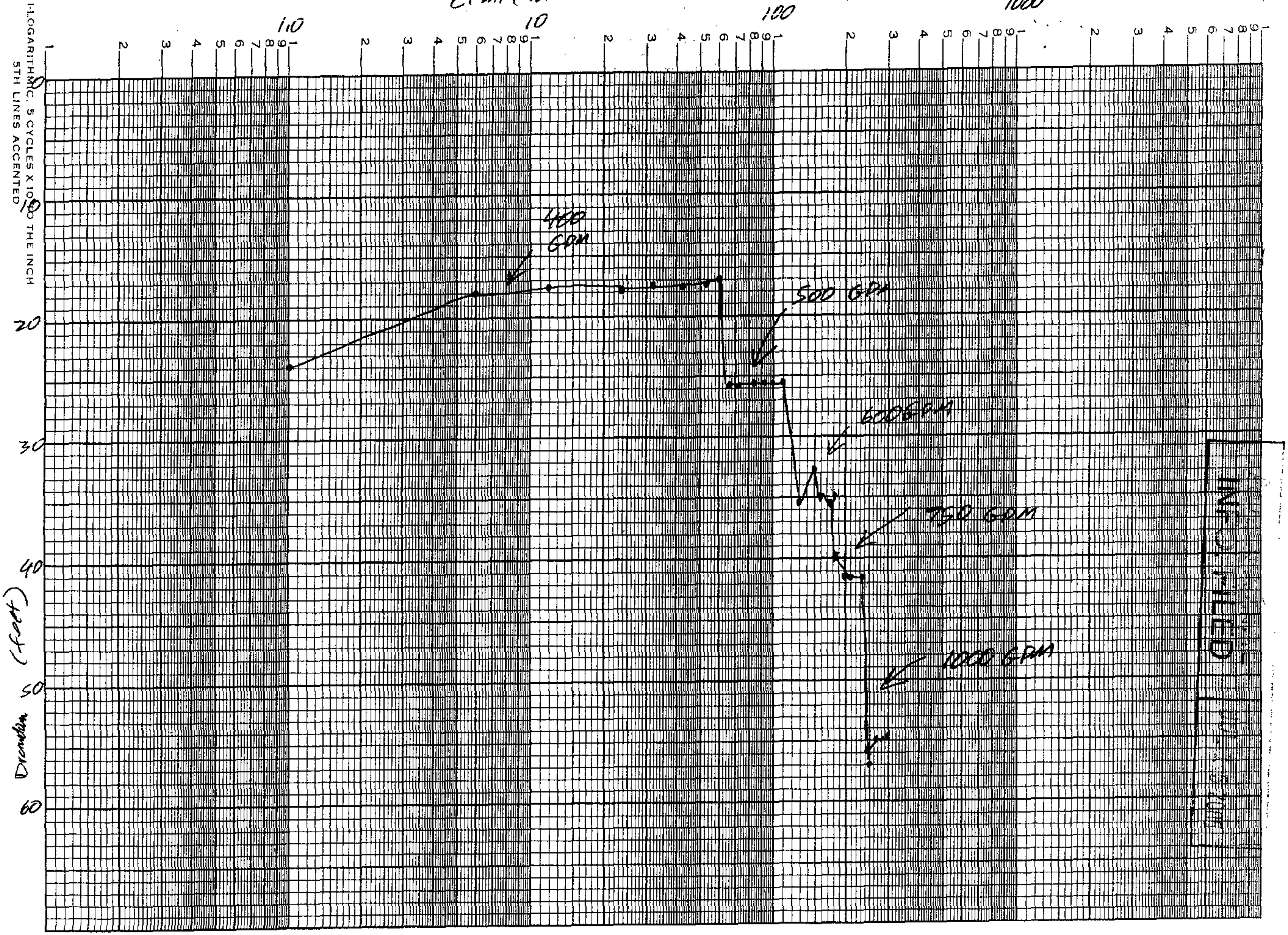
time (minutes) →

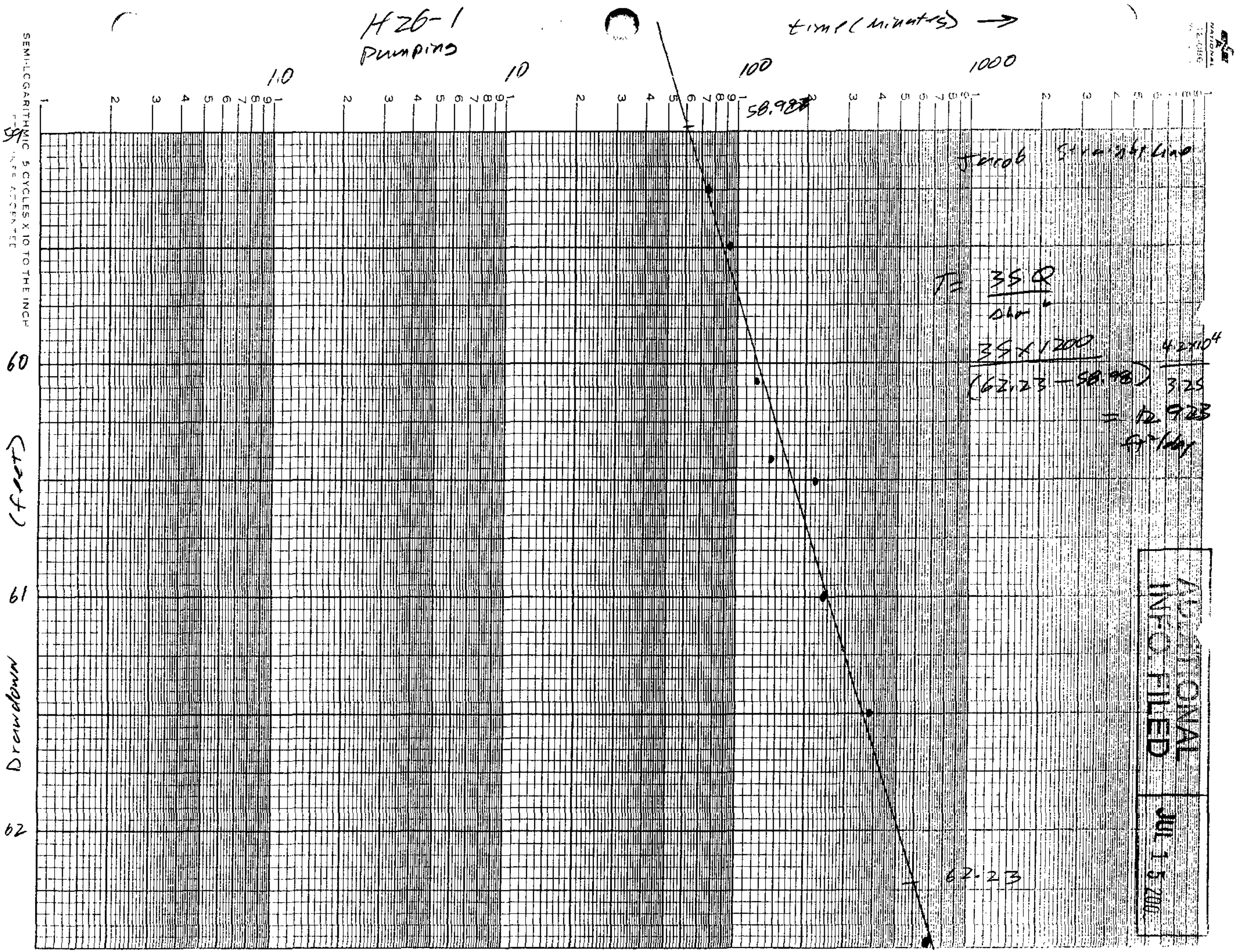


SIDNEY WELL H26-1

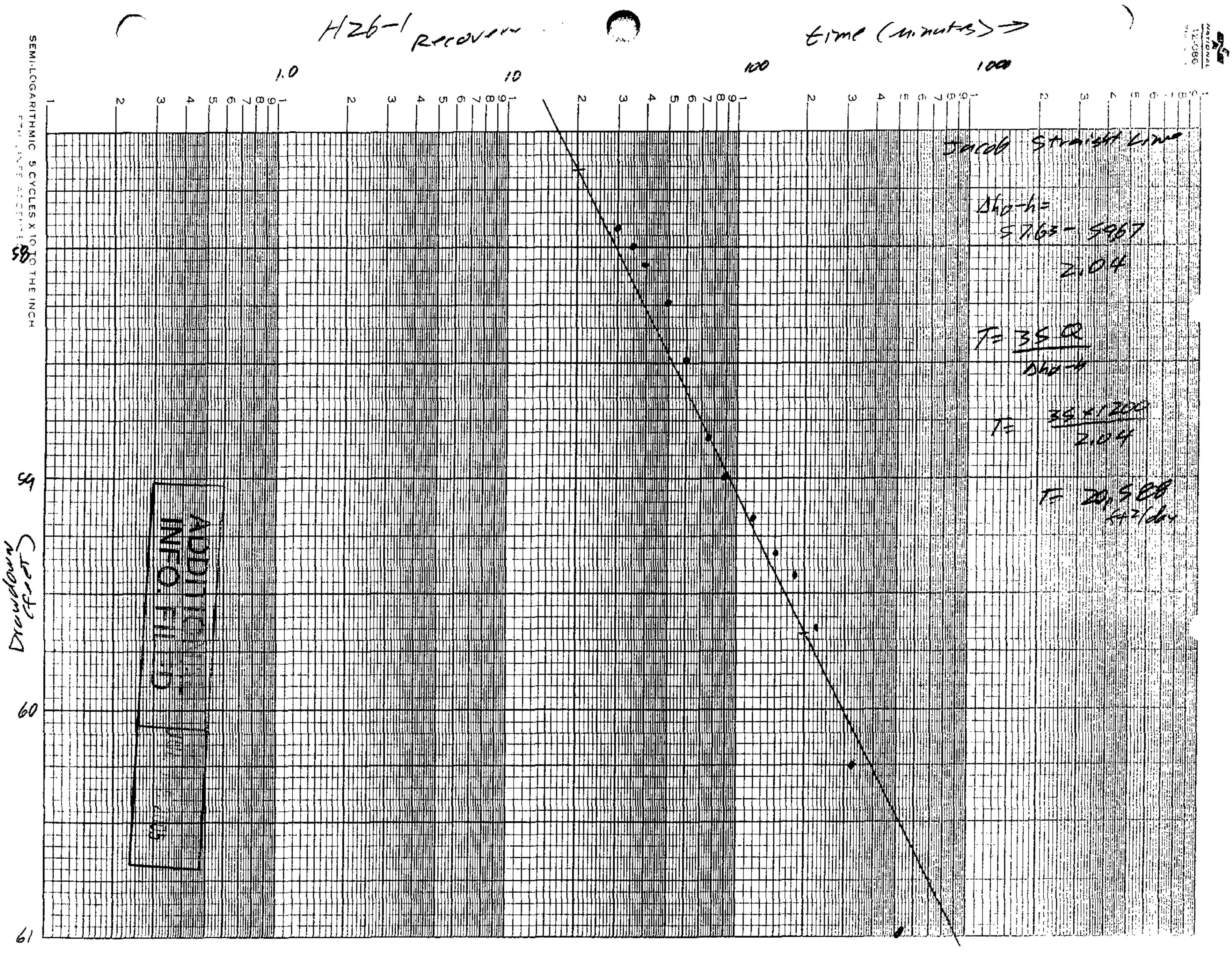
STEP/EFFICIENCY TEST
H26-1 PUMPING DATA
H26-1 RECOVERY DATA
SOUTH WATER SUPPLY WELL PUMPING DATA
SOUTH WATER SUPPLY WELL RECOVERY DATA
NORTH WATER SUPPLY WELL PUMPING DATA
NORTH WATER SUPPLY WELL RECOVERY DATA

Well HZ6-1 Step Efficiency Test





H26-1
pumping
time (minutes) →
1.0
10
100
1000
58.98
Jacob Straight Line
T = 35Q / Δh
35 × 1200 / (62.23 − 58.98)
4.2×10^4 / 3.25
= 12,923
ft²/day
62.23
Drawdown (feet)
59
60
61
62
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
ADDITIONAL INFO FILED

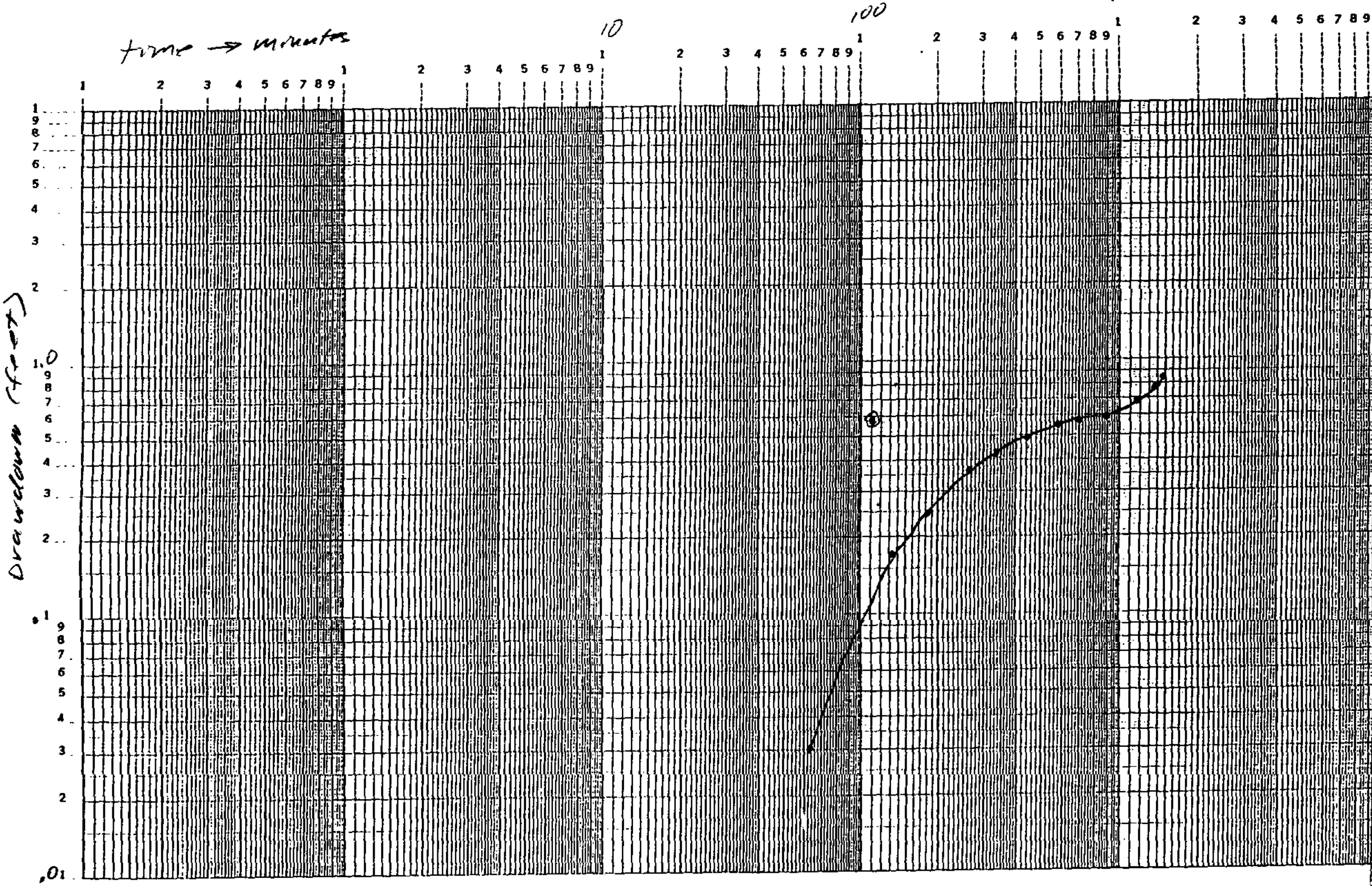

HZ6-1 Recovery
time (minutes) →
1.0
10
100
1000
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
Jacob Straight Line
Δho-h = 57.63 - 59.67
2.04
T = 35 Q / Δho-h
T = 35 × 1200 / 2.04
T = 20,588 ft²/day
Drawdown (feet)
58
59
60
61
AUDIT INFO. FILED

South water supply well

K·E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

SWS 46 7520

(HZ6-1 Pump)



Match

$\Delta h_o - h = 0.59$ feet

$\Delta t = 110$ min.

$$T = \frac{15.3 \times 1200 \text{ GPM}}{0.59 \text{ feet}} = 31,119 \text{ ft}^2/\text{day}$$

$$S = \frac{31119 \times 110 \times 1}{360 (1200)^2} = 0.0066$$

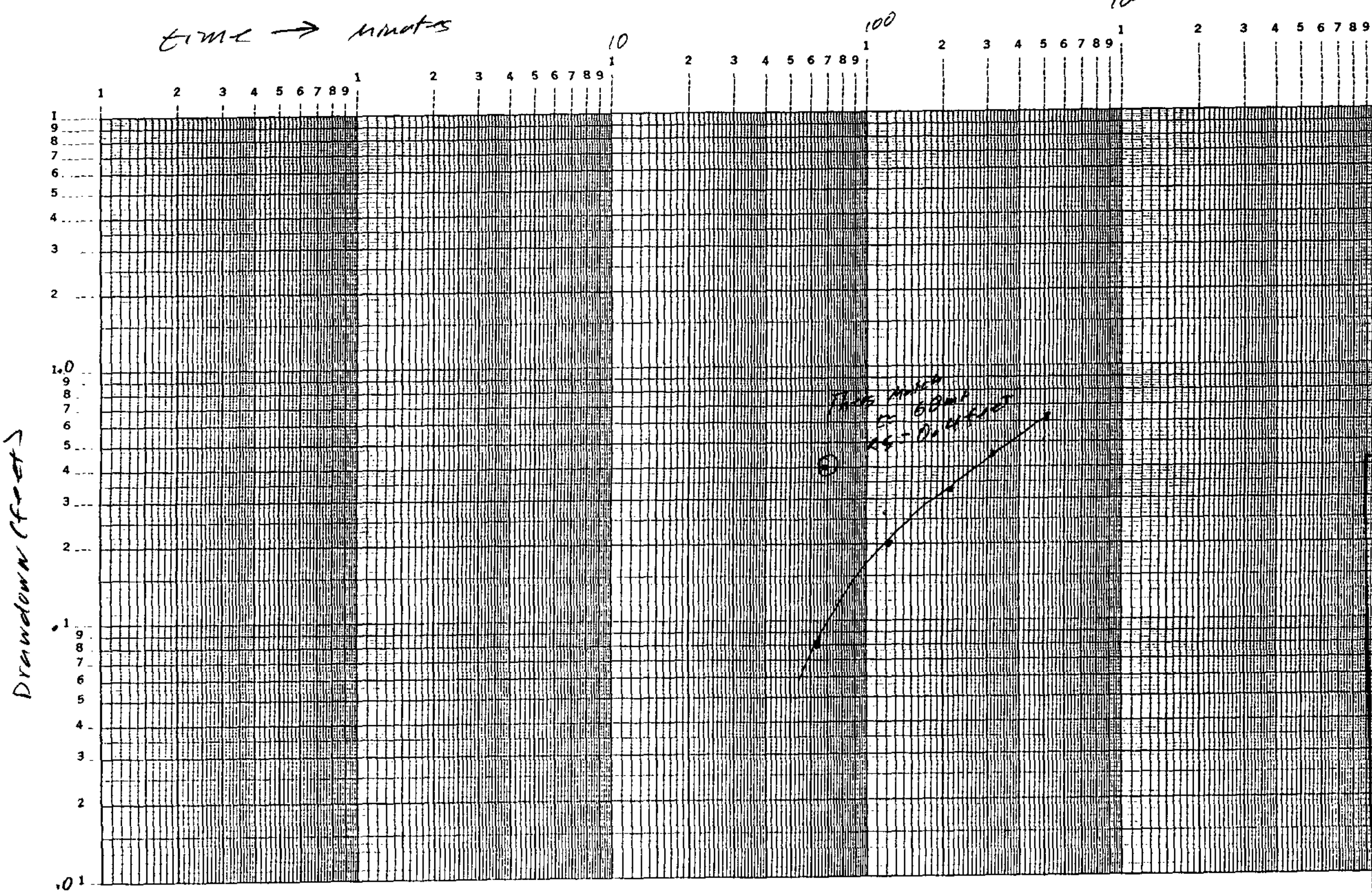
K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

SWS
South water supply well

H26-1 Recovery

time → minutes



match =
Δho-h = 0.4 feet
Δt = 68 min

$$T = \frac{15.3 \times 1200\text{ GPM}}{0.4\text{ feet}} = 45{,}900\ \text{ft}^2/\text{day}$$

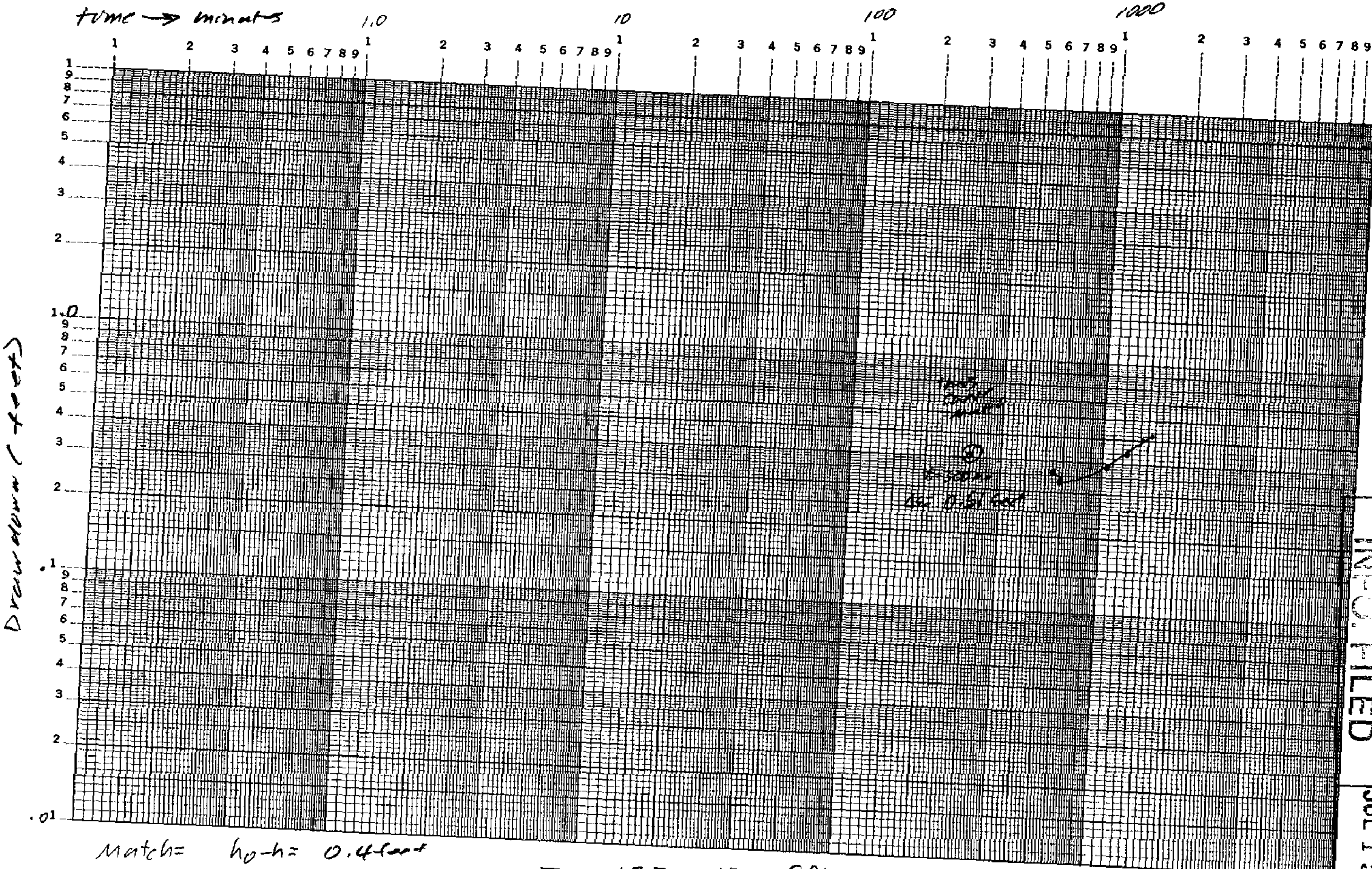
$$S = \frac{45900 \times 68 \times 1}{360(1200)^2} = 0.006$$

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

North water supply well

NWS (H26-1 24 Hour Pump)



Match = $h_0 - h$ = 0.4 feet
Δt 300 min

$$T = \frac{15.3 \times 1200\ \text{GPM}}{0.4\ \text{feet}} = 45{,}900\ \text{ft}^2/\text{day}$$

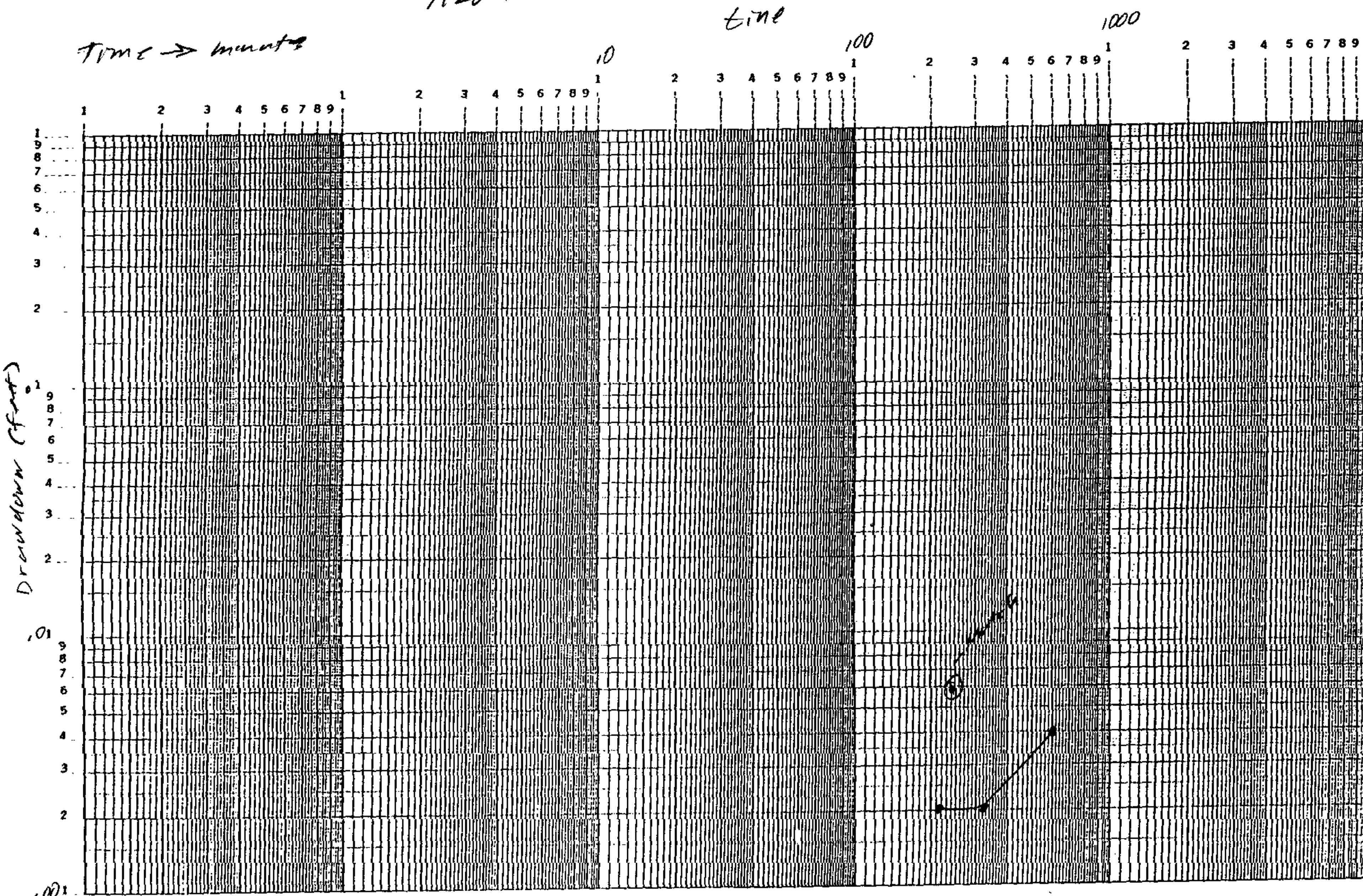
$$S = \frac{45{,}900 \times 300 \times 1}{360\ (3800)^2} = 0.0026$$

NWS North water supply well

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

H26-1 Recovery



Match h₀-h = 0.05 feet
Δt = 240 min

$$T = \frac{15.3 \times 1200\text{ GPM}}{0.05\text{ feet}} = 367{,}000\ \text{ft}^2/\text{day}$$

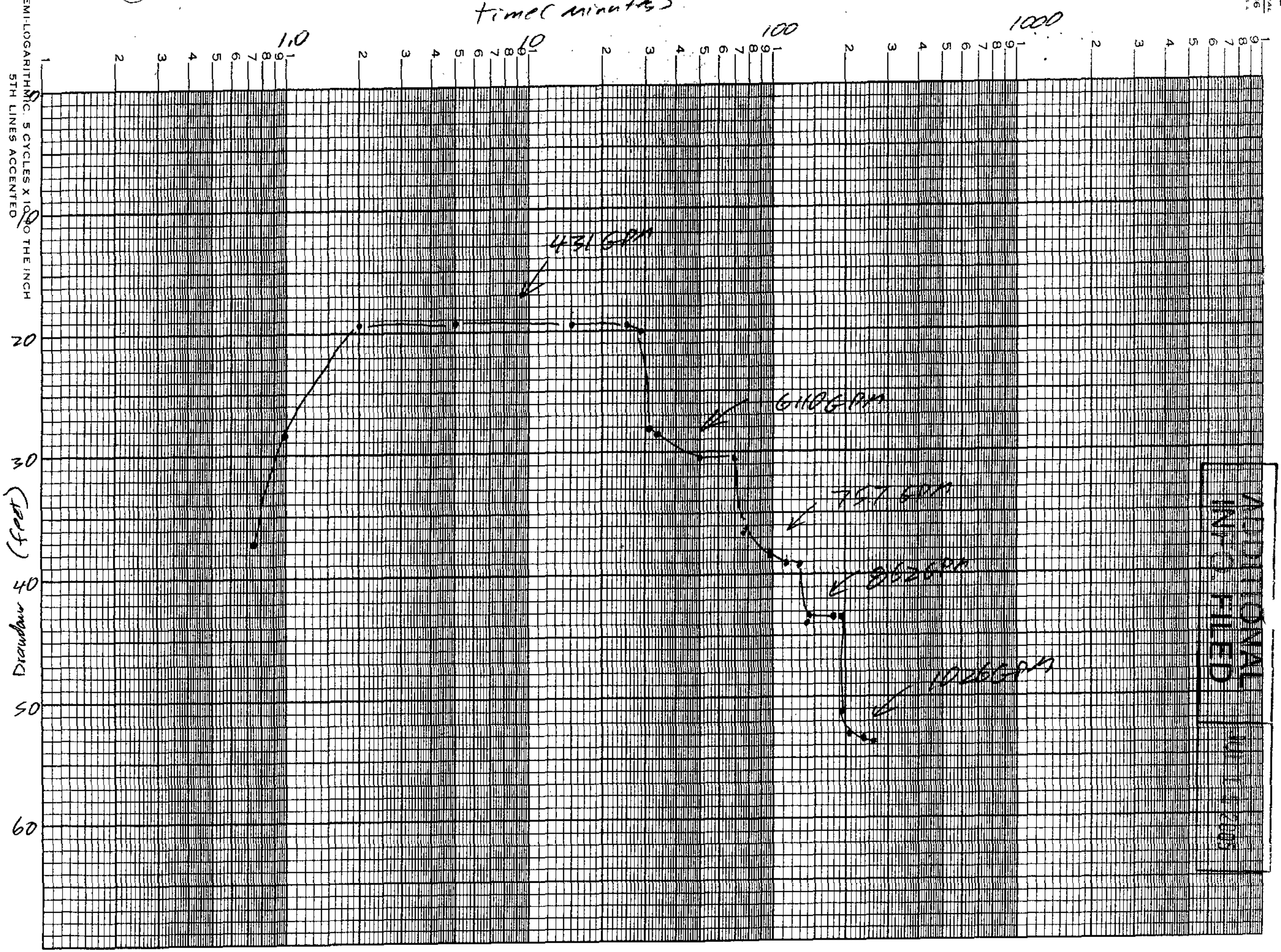
$$S = \frac{367{,}000 \times 240 \times 1}{360(3800)^2} = 0.017$$

PUMP TEST DATA

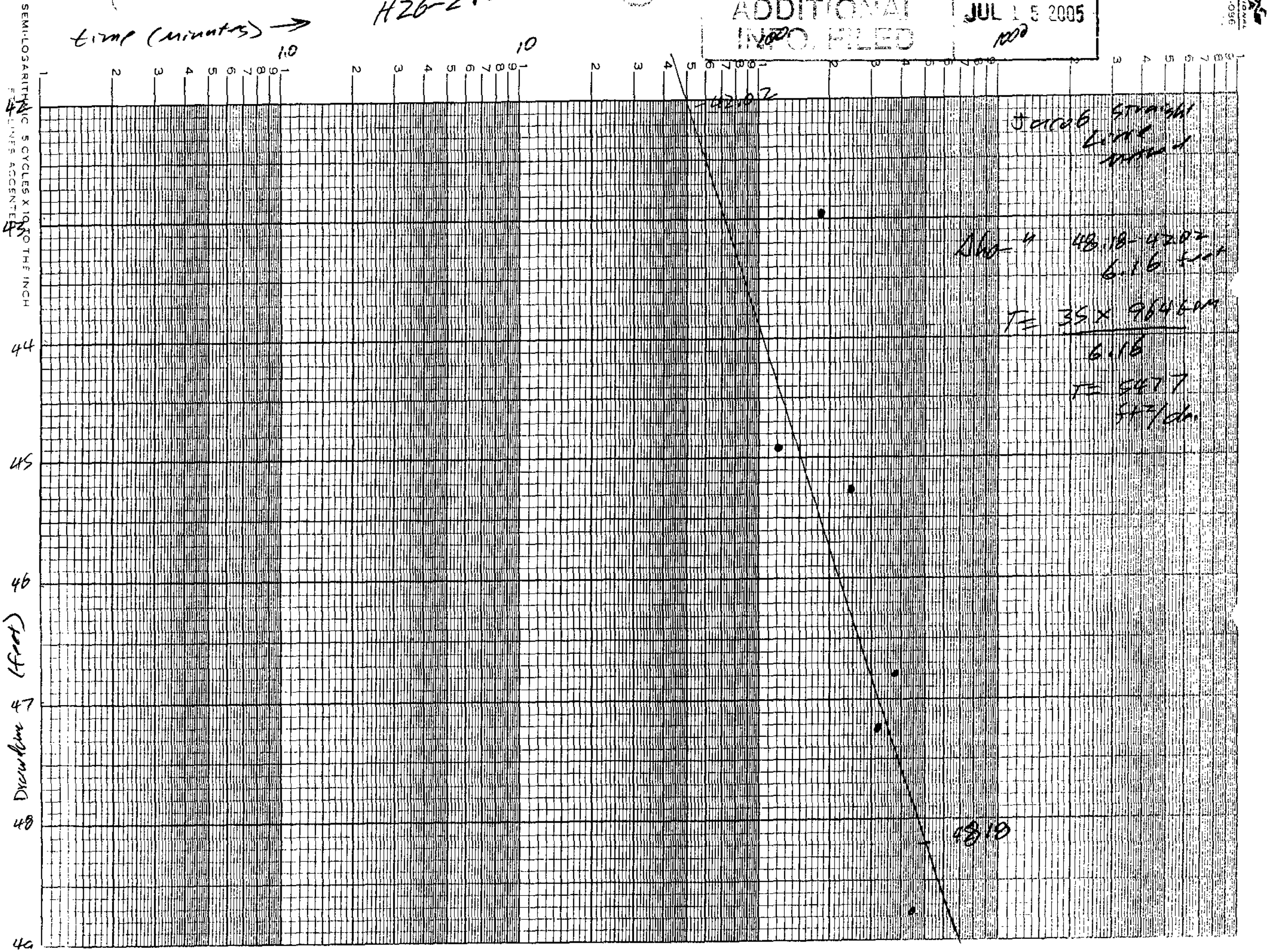
SIDNEY WELL H26-2

STEP/EFFICIENCY TEST
H26-2 PUMPING DATA
H26-2 RECOVERY DATA
H26-1 PUMPING DATA
H26-1 RECOVERY DATA
H26-5 PUMPING DATA
SOUTH WATER SUPPLY WELL PUMPING DATA
NORTH WATER SUPPLY WELL PUMPING DATA
H26-2 DISTANCE-DRAWDOWN ANALYSIS

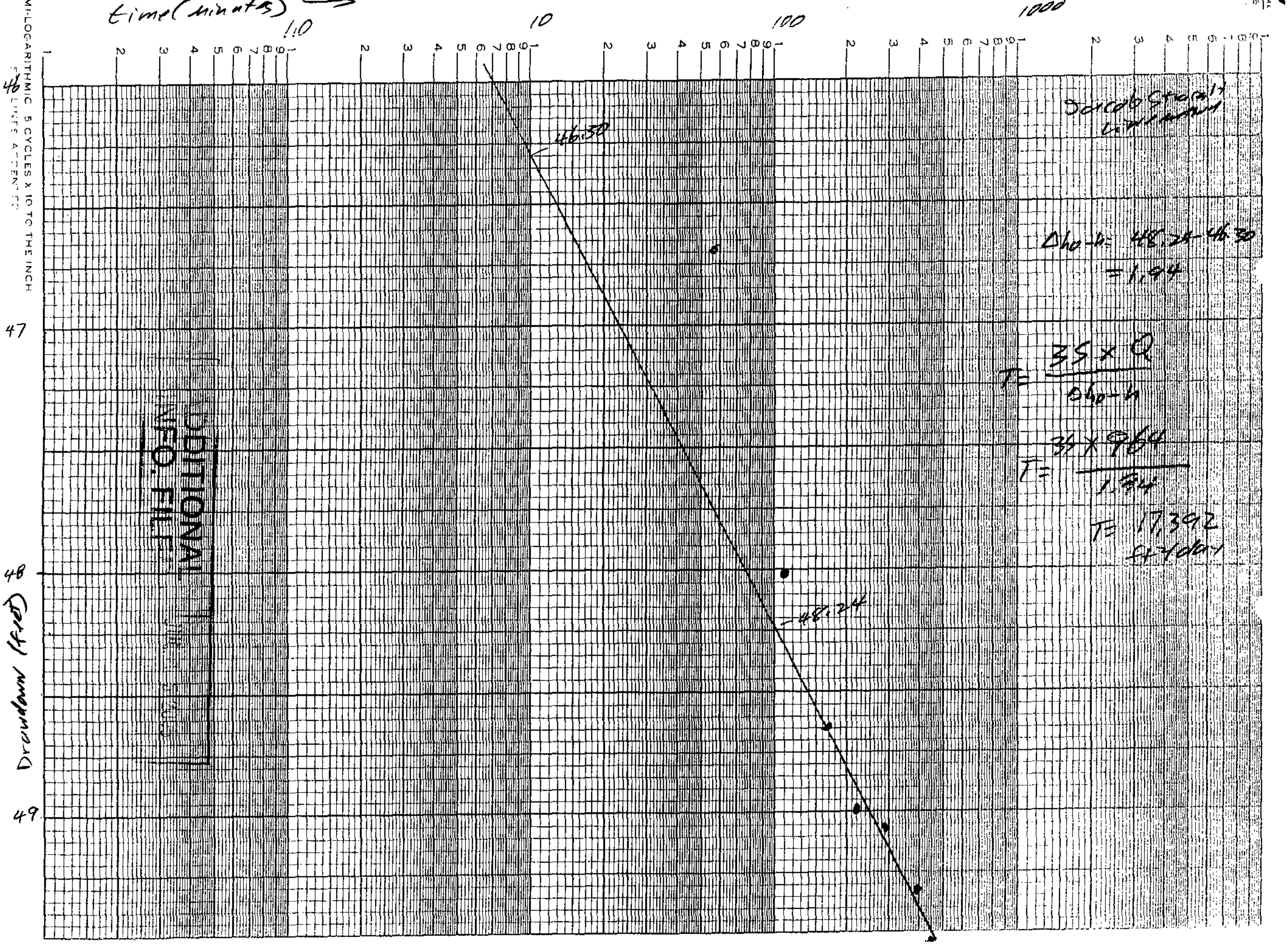
H 26-2 Step-Efficiency test



H26-2 Pump.


time (minutes) →
1.0
10
100
1000
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
5TH LINES ACCENTED
NATIONAL 12-096
42
43
44
45
46
47
48
49
Drawdown (feet)
42.02
48.18
Jacob straight line method
Δh = 48.18 - 42.02
6.16 feet
T = 35 x 964 gpm / 6.16
T = 5477 ft²/day

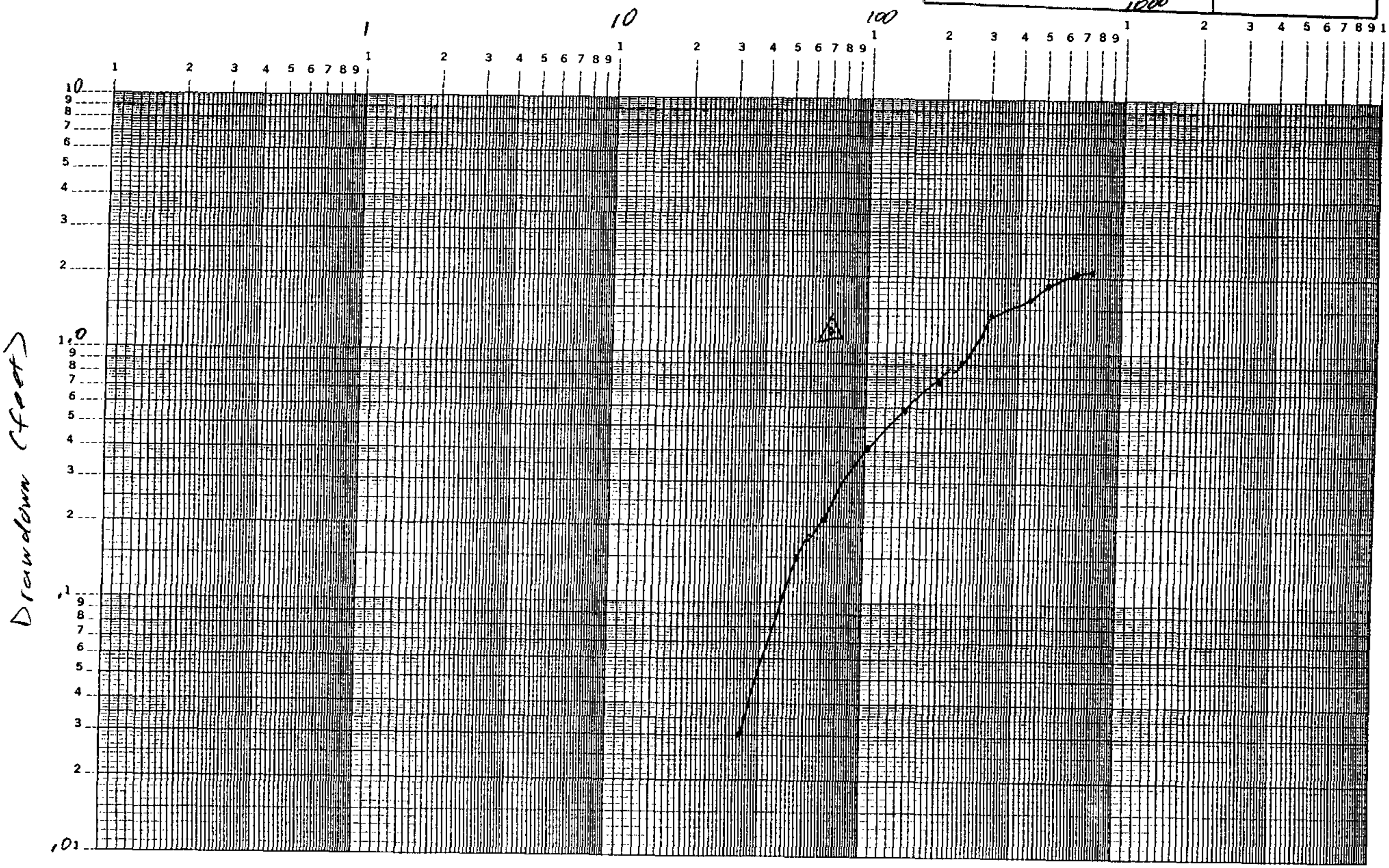
H26-2 Recovery



K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

H26-1 (H26-2 Pump)



ΔS 1.2 ft
t 71 min.
Q = 960 gpm
r 2350 feet

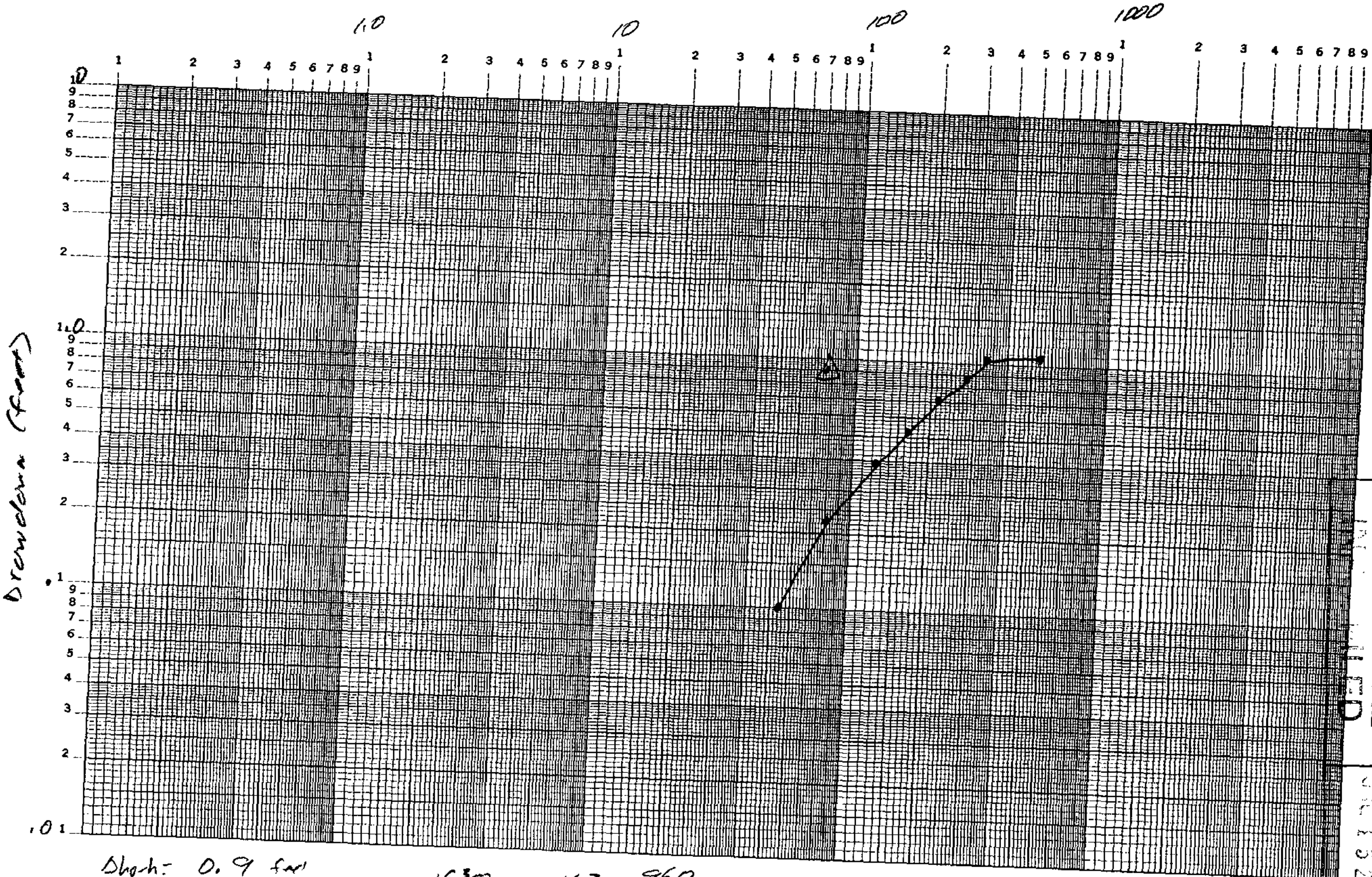
$$T = \frac{15.3Q}{\Delta s} = \frac{15.3 \times 960}{1.2} = 12240 \text{ ft}^2/\text{day}$$

$$S = \frac{12240 \times 71 \times 1}{360 (2350)^2} = 0.00044$$

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

HZ6-1 (HZ6-2 Recovery)



Δh_{0}-h: 0.9 feet

Δt = 78 min

r = 2250'

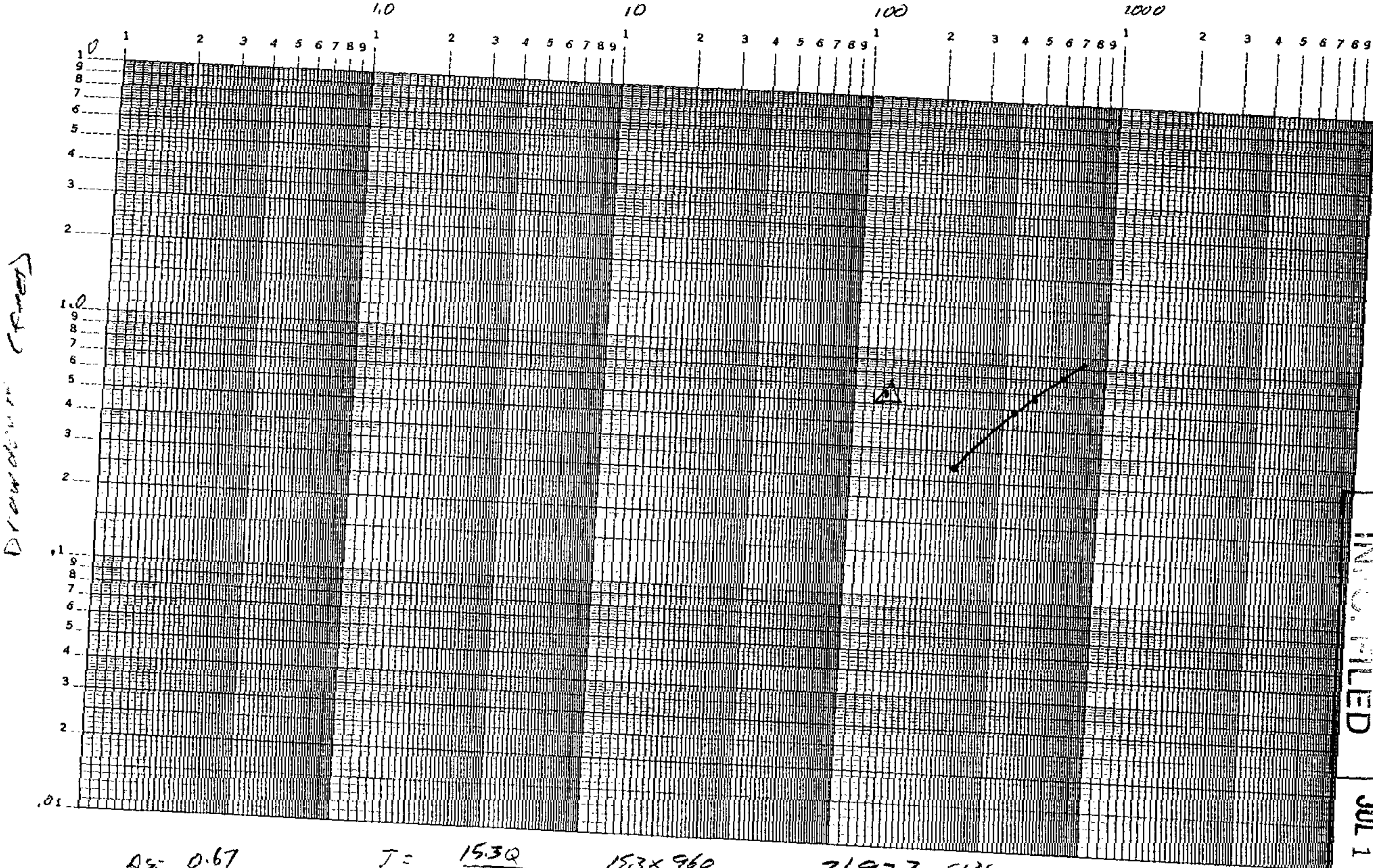
$$T = \frac{15.3Q}{\Delta h_{0}\text{-}h} = \frac{15.3 \times 960}{0.9} = 16320 \text{ ft}^2/\text{day}$$

$$S = \frac{16320 \times 78 \times 1}{360\,(2250)} = 0.00070$$

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

H 26-S OW (H26-Z Pump) time (minutes) →



$\Delta s = 0.67$

$t = 135$

$Q = 960$

$r = 4300$

$$T = \frac{15.3Q}{\Delta s} = \frac{15.3 \times 960}{0.67} = 21922 \text{ ft}^3/\text{day}$$

$$S = \frac{21922 \times 135 \times 1}{360 (4300)^2} = 0.00044$$

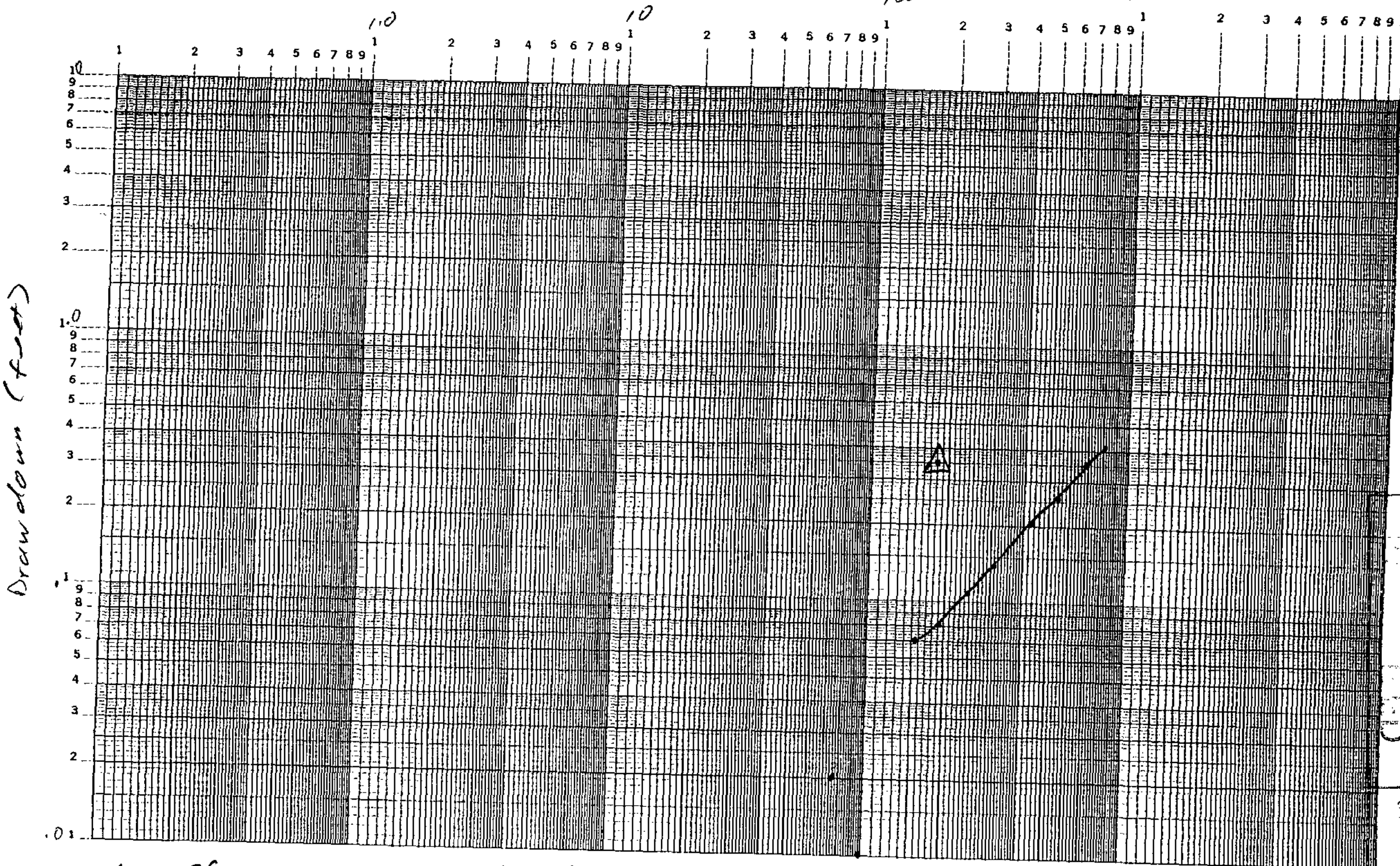
K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

South water supply well

SWS (H26-Z Pump)

time (minutes) →



$\Delta s = 0.35$

t 180 m

$Q = 960$ GPM

$r = 2400'$

$$T = \frac{15.3 Q \times 1}{\Delta s} = \frac{15.3 \times 960 \times 1}{0.35} = 41{,}966 \text{ ft}^2/\text{day}$$

$$S = \frac{41966 \times 180 \times 1}{360\ (2400)^2} \quad 0.00364$$

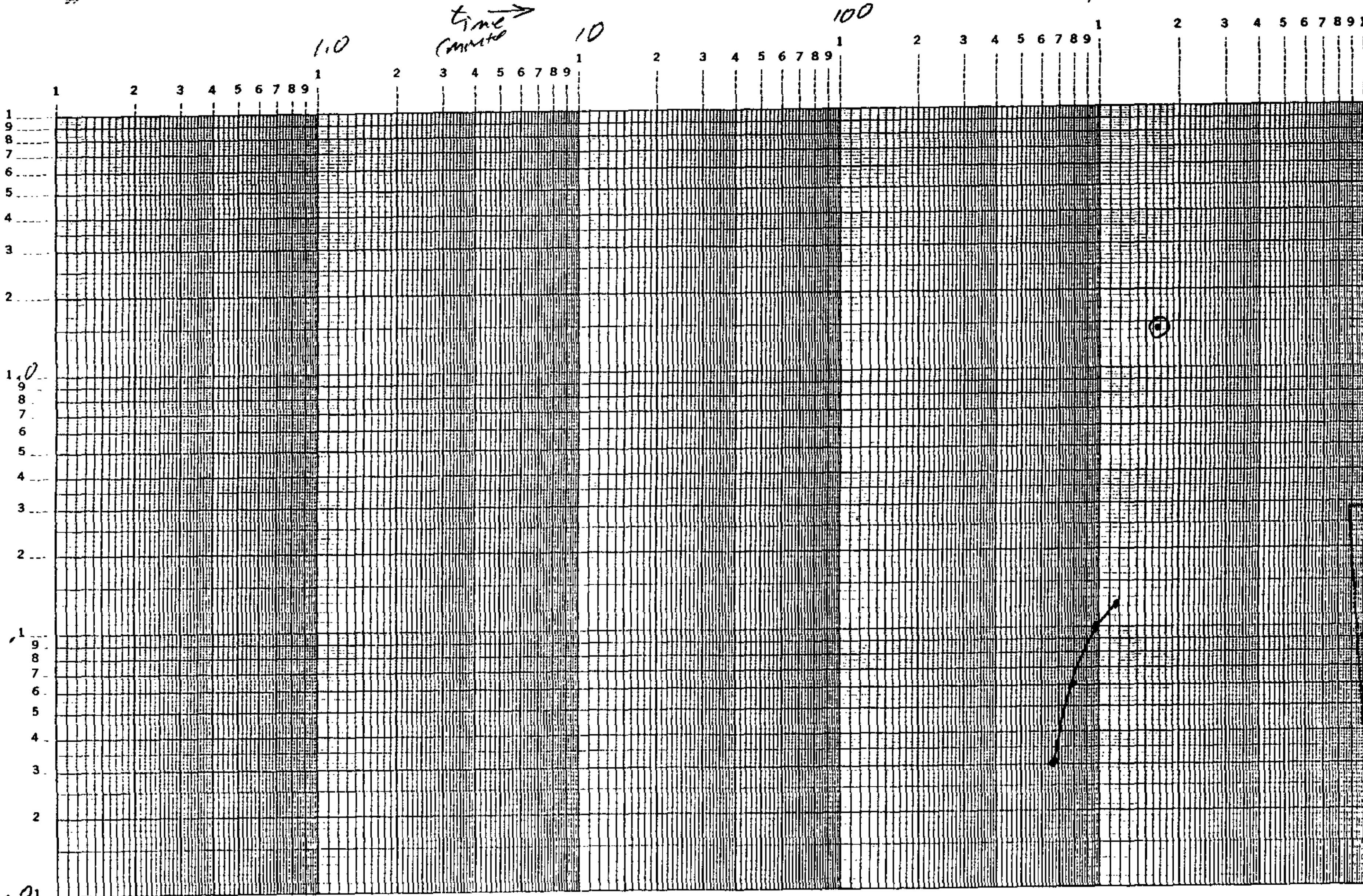
K·E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520

North water supply well

H26-2 PUMP

NWS (Pump)

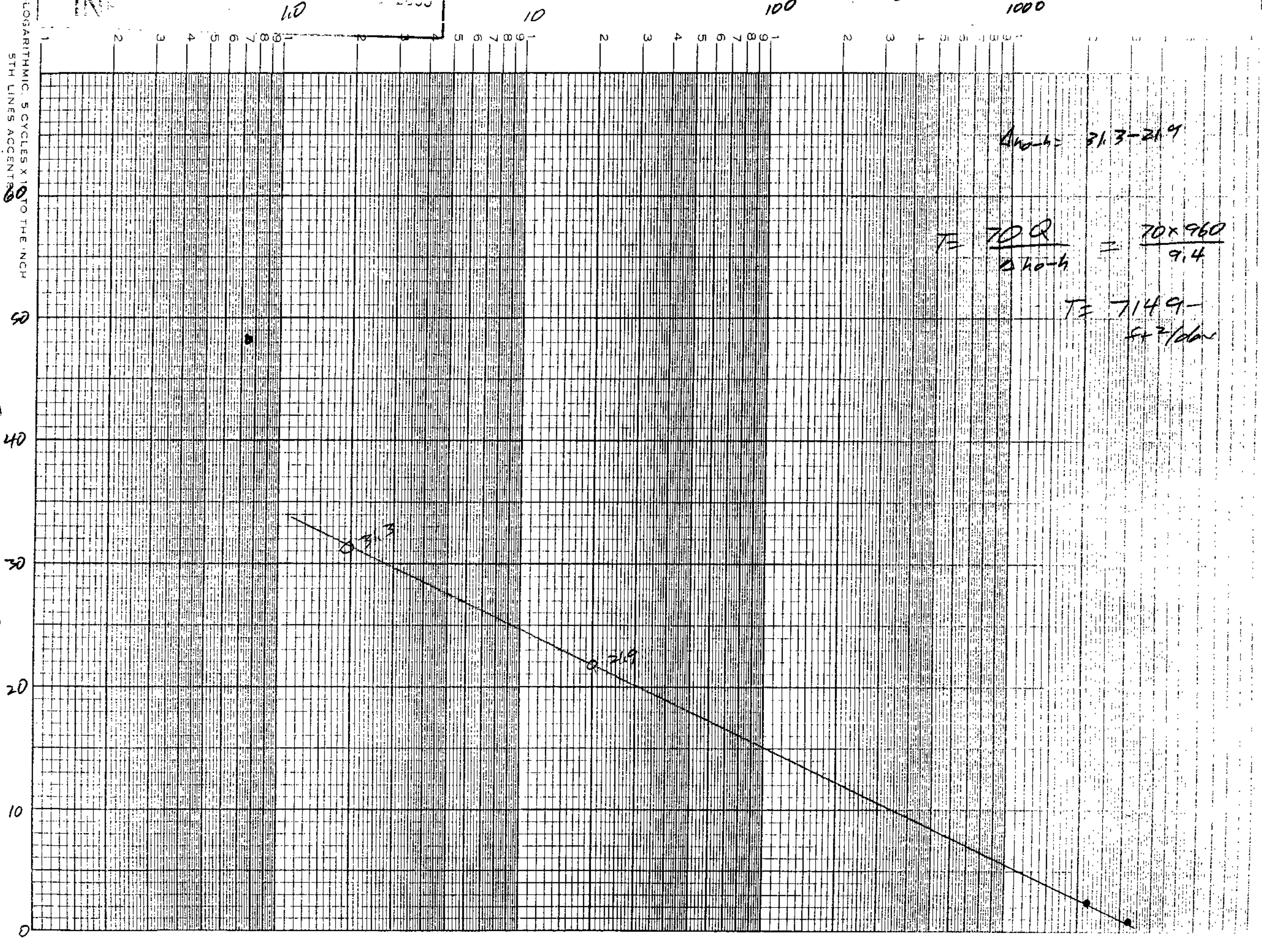


Theis Match
Δh = 1.4 feet
Δt 1650 min.

$$T = \frac{15.3\,Q}{\Delta s} = \frac{15.3 \times 960\ \text{gpm}}{1.4\ \text{feet}} = 10{,}491\ \text{ft}^2/\text{day}$$

$$S = \frac{10491 \times 1660 \times 1}{360\,(4800)^2} = 0.0021$$

H26-2 Distance Drawdown

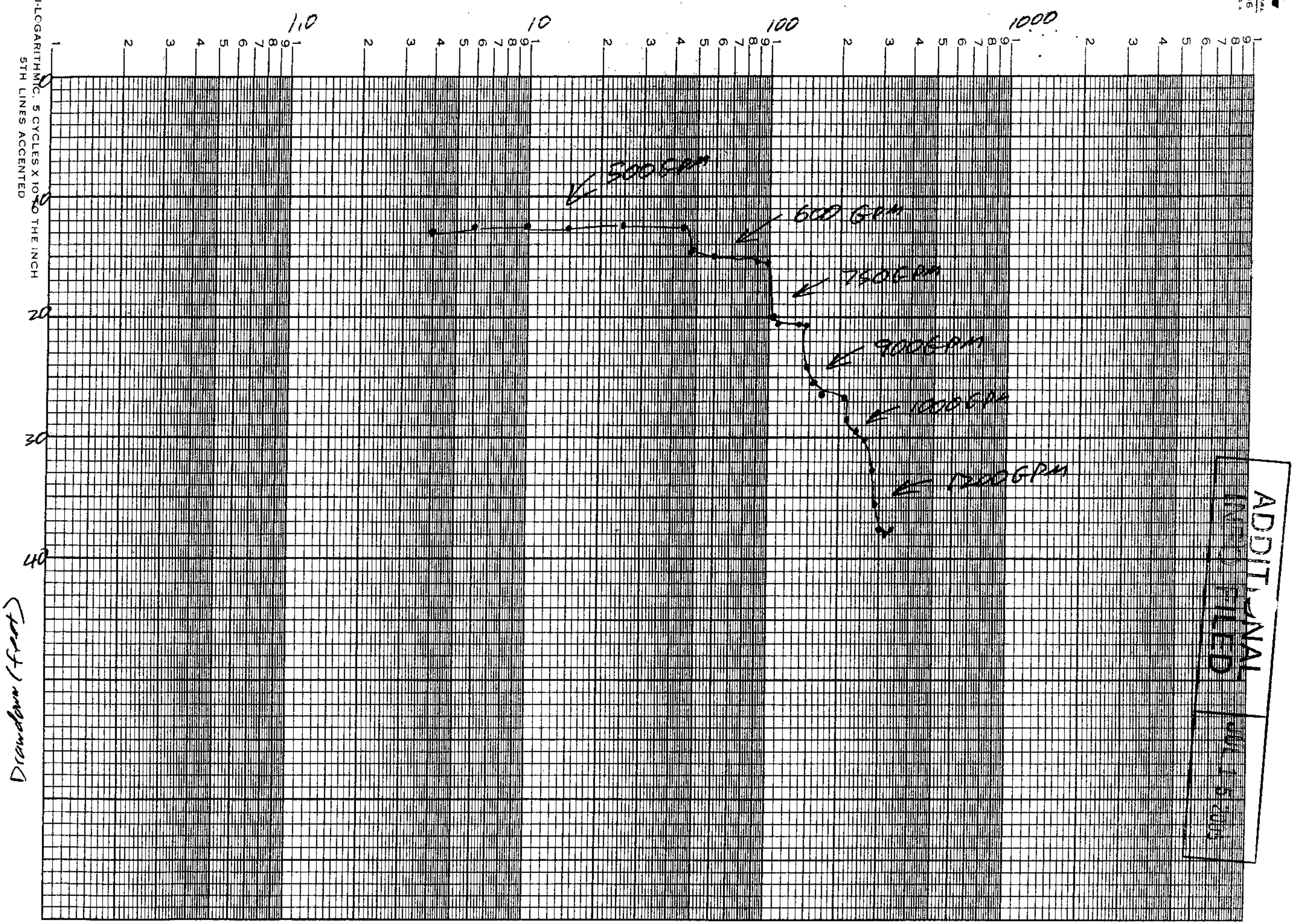


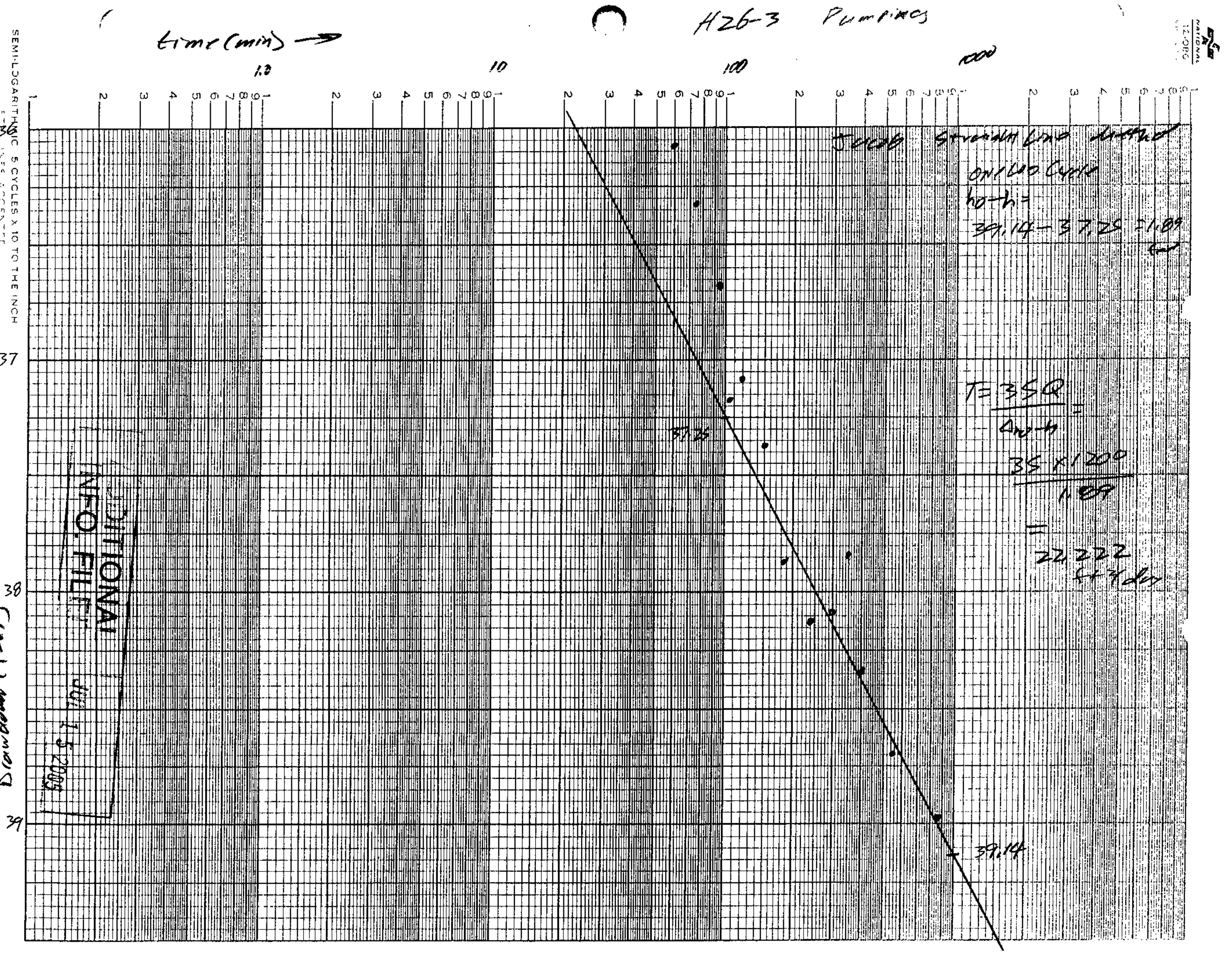
PUMP TEST DATA

SIDNEY WELL H26-3

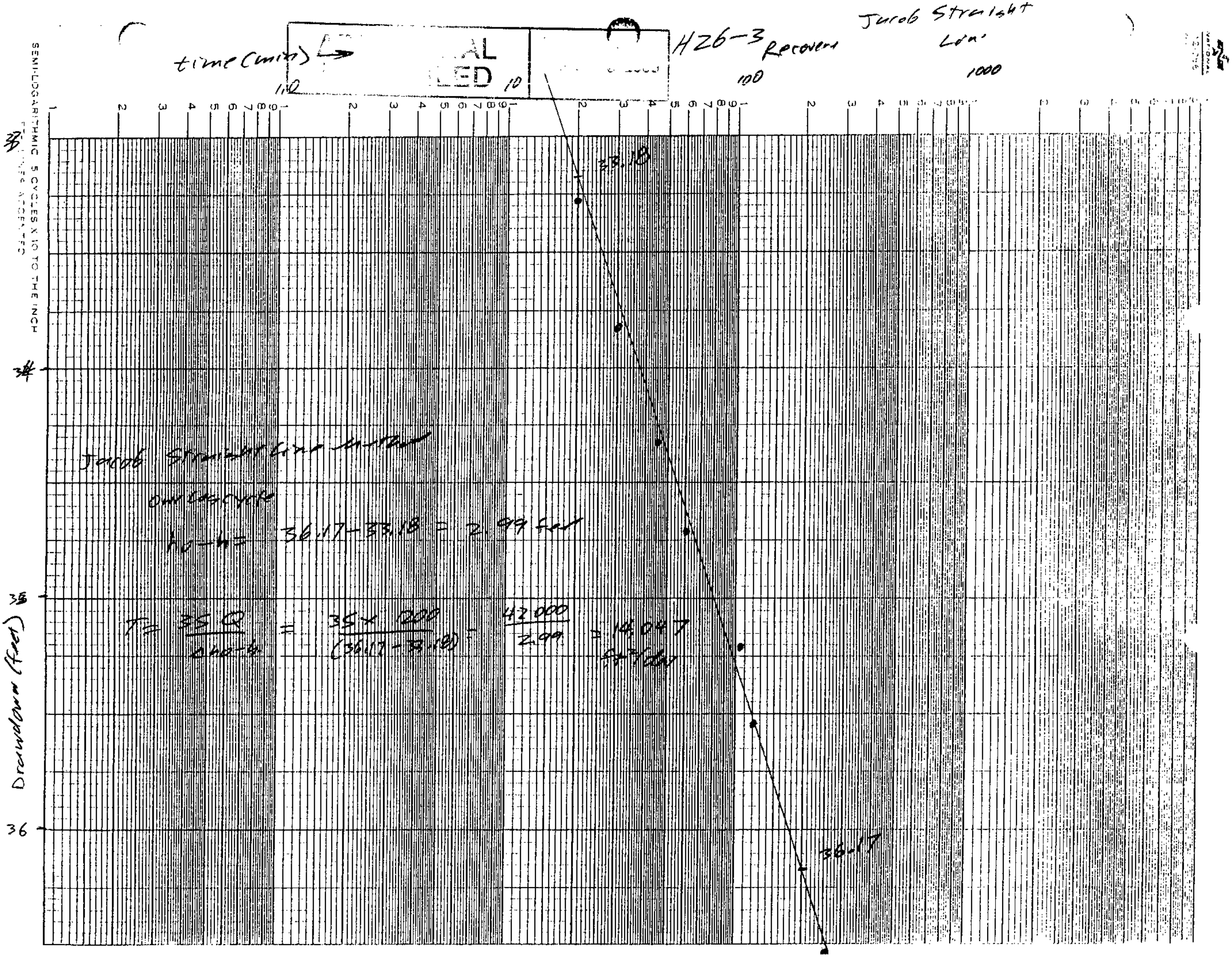
STEP/EFFICIENCY TEST
H26-3 PUMPING DATA
H26-3 RECOVERY DATA
H26-1 PUMPING DATA
H26-1 RECOVERY DATA
H26-2 PUMPING DATA
H26-2 RECOVERY DATA
H26-3 DISTANCE-DRAWDOWN ANALYSIS

H 26-3 Step/Efficiency Test





H26-3 Pumping
time (min) →
1.0
10
100
1000
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
Drawdown (feet)
36
37
38
39
37.25
39.14
Jacob Straight Line drawn
on 1 Log Cycle
h0-h =
39.14 - 37.25 = 1.89
T = 35Q / (h0-h) =
35 × 1200 / 1.89
= 22,222
ft²/day
DITIONAL
INFO. FILE
JUL 15 2003


HZ6-3 Recovery
Jacob Straight Line
time (min)
1.0
10
100
1000
33.18
36.17
Drawdown (feet)
34
35
36
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
Jacob Straight Line
h0 - h = 36.17 - 33.18 = 2.99 feet
T = 35 Q / Δh0-h = 35 × 1200 / (36.17 - 33.18) = 42,000 / 2.99 = 14,047 ft²/day

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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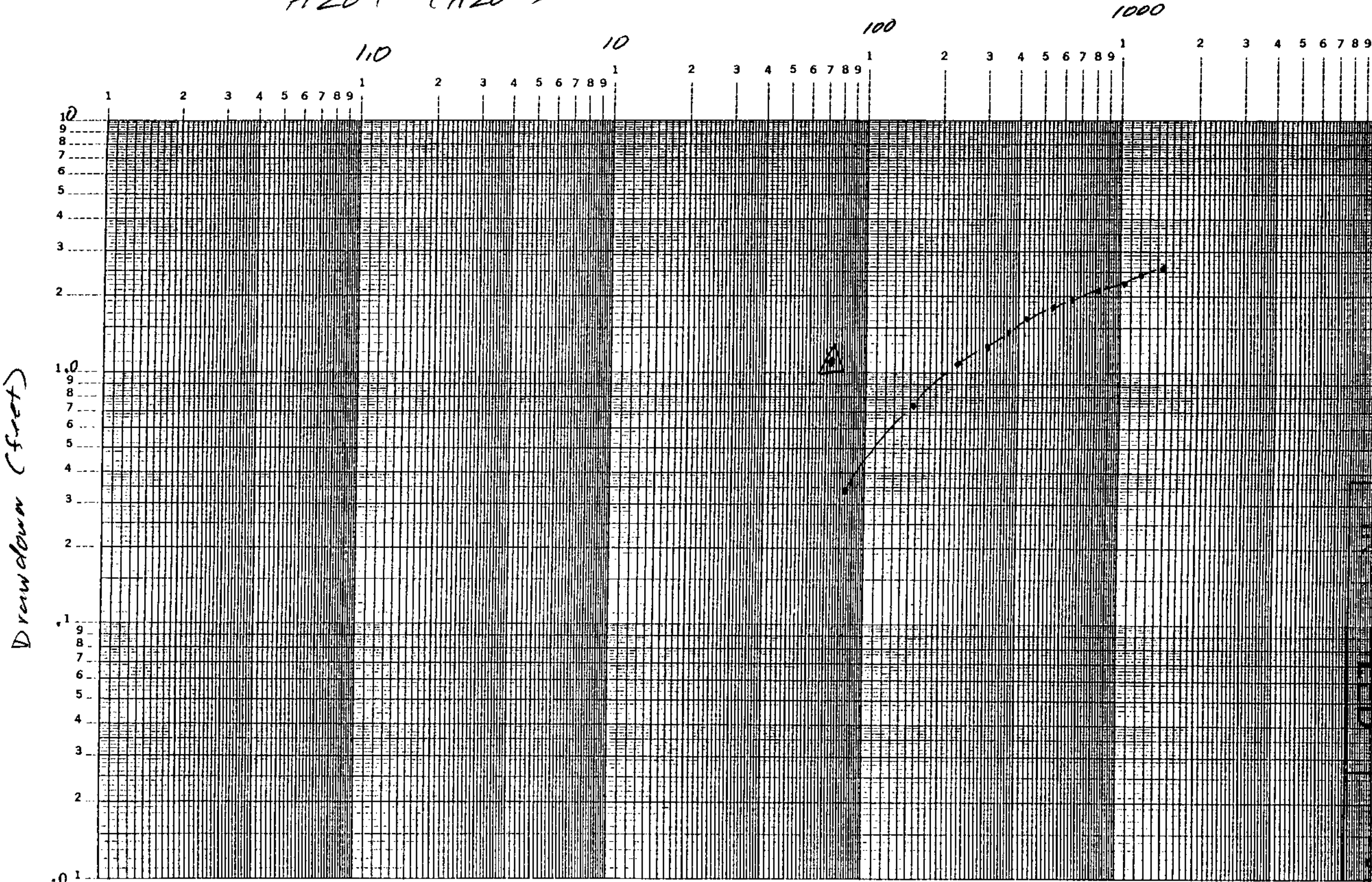
HZ6-1 (HZ6-3 Pump)



$\Delta h_o - h = 1.1$ feet

$\Delta t = 62$ min

$$T = \frac{15.3Q}{\Delta s} = \frac{15.3 \times 1200}{1.1} = 16691 \text{ ft}^2/\text{day}$$

$$S = \frac{T \;\Delta t \times 1}{360 \;(r^2)} \quad \frac{16691 \times 62 \times 1}{360 \;(2600)} = 0.00043$$

K•E LOGARITHMIC 3 x 5 CYCLES
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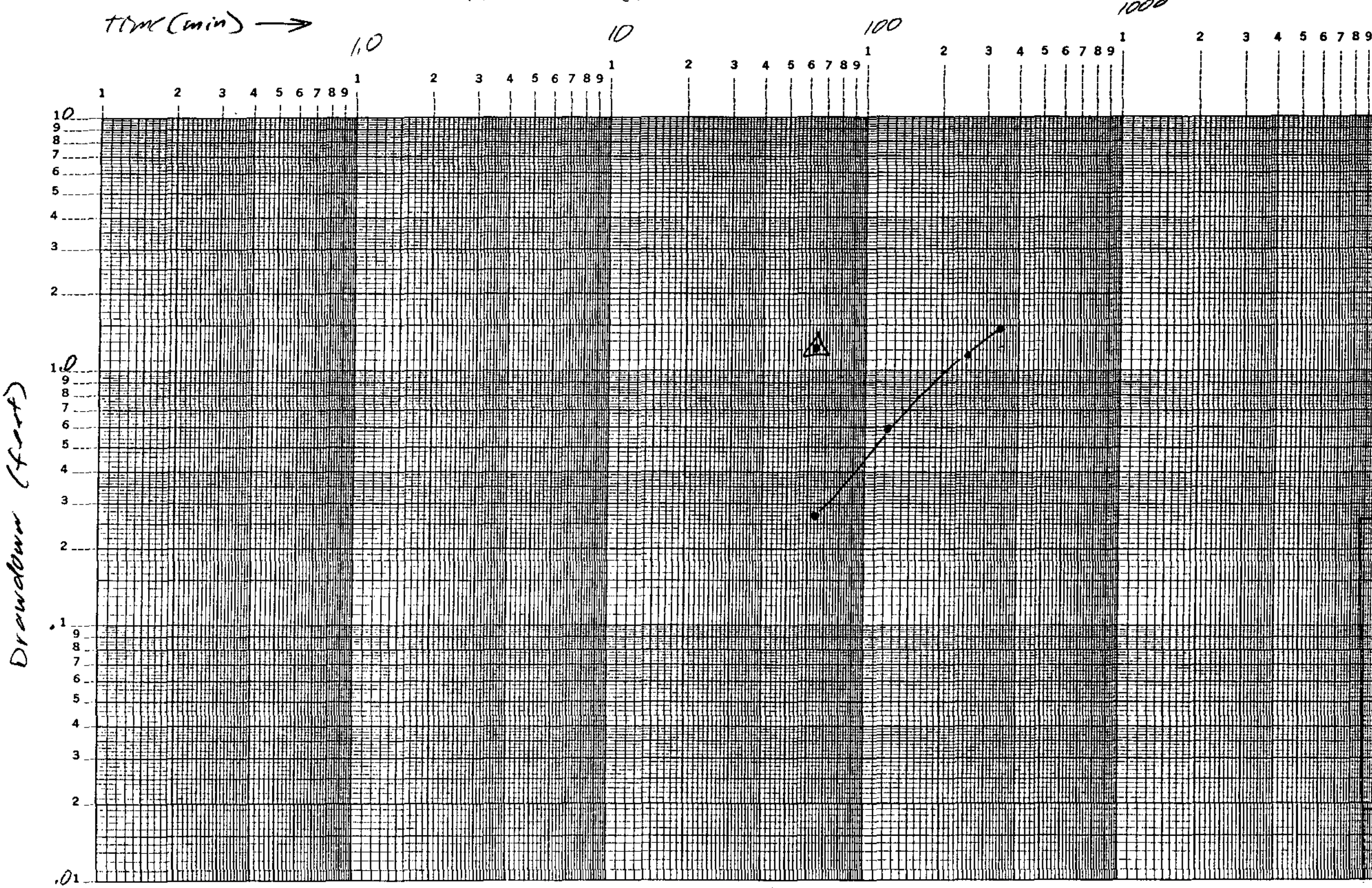
H26-1 (H26-3 Recovery)



$\Delta h_0 - h = 1.2$ feet

$t = 62$ min

$$T = \frac{15.3Q}{\Delta h_0 - h} = \frac{15.3 \times 1200}{1.2} = 15300 \text{ ft}^2/\text{day}$$

$$S = \frac{15300 \times 62 \times 1}{360 (2600)^2} = 0.00039$$

K•E LOGARITHMIC 3 x 5 CYCLES
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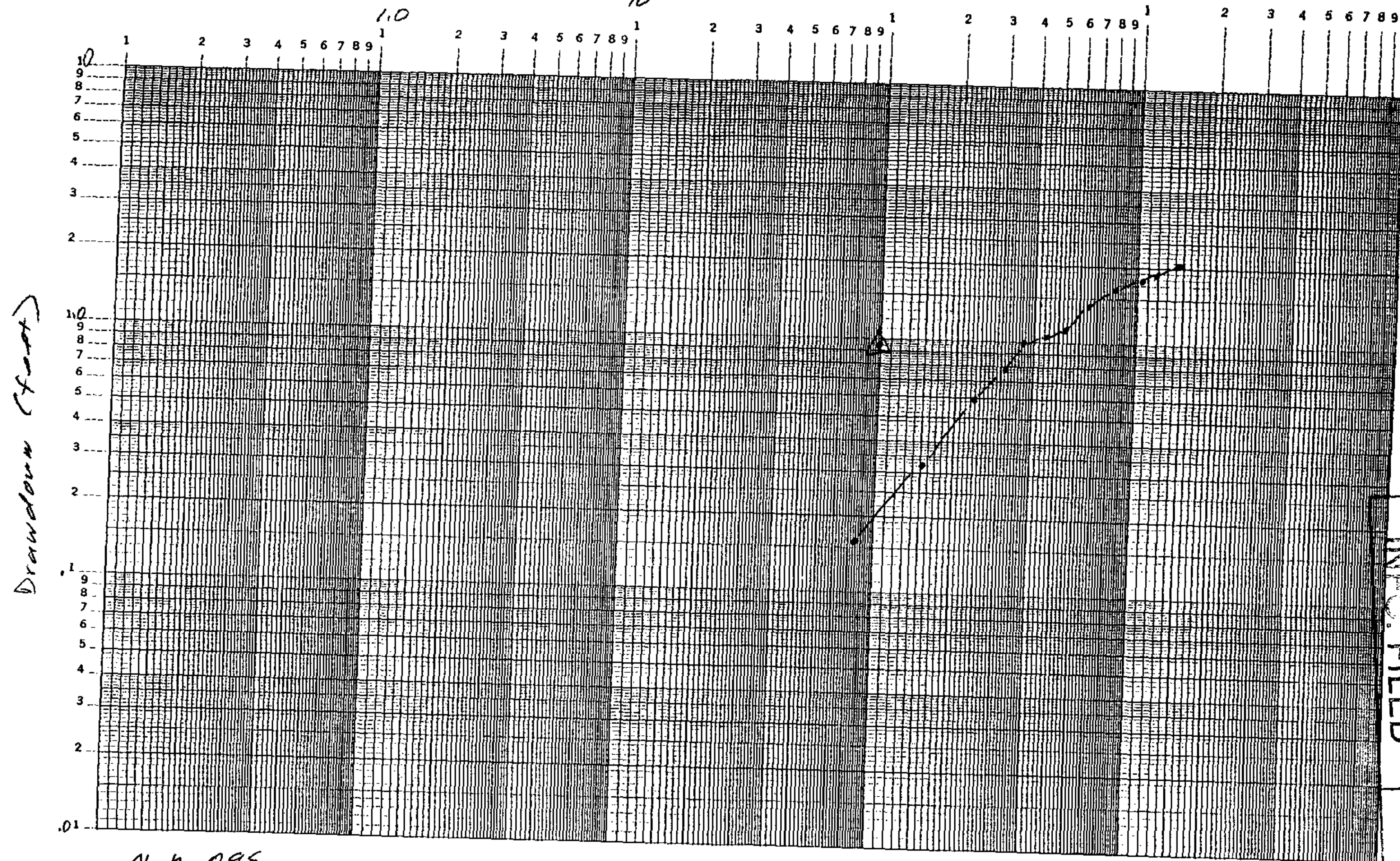
H 26-2 (H26-3 Pump)

time (min) →



Δh_{0-h} 0.95

Δt 100

$$T = \frac{15.3Q}{\Delta h_{0-h}} \qquad T = \frac{15.3 \times 1200}{0.95} = 19326 \text{ ft}^2/\text{day}$$

$$S = \frac{T \times \Delta t \times 1}{360(r^2)} \qquad \frac{19326 \times 100 \times 1}{360(3350)^2} = 0.00048$$

K•E LOGARITHMIC 3 x 5 CYCLES
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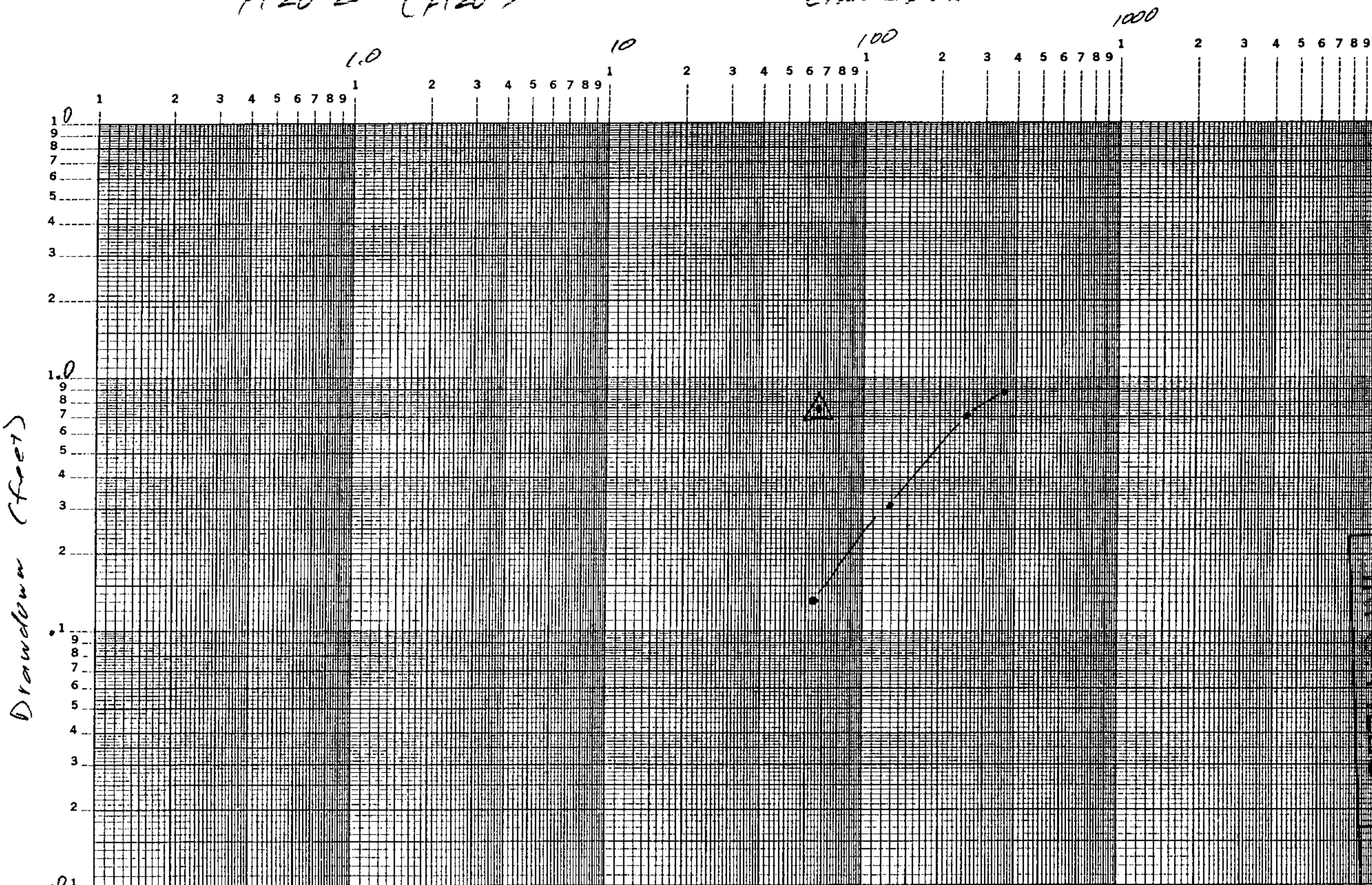
H26-2 (H26-3 Recovery)

time → min



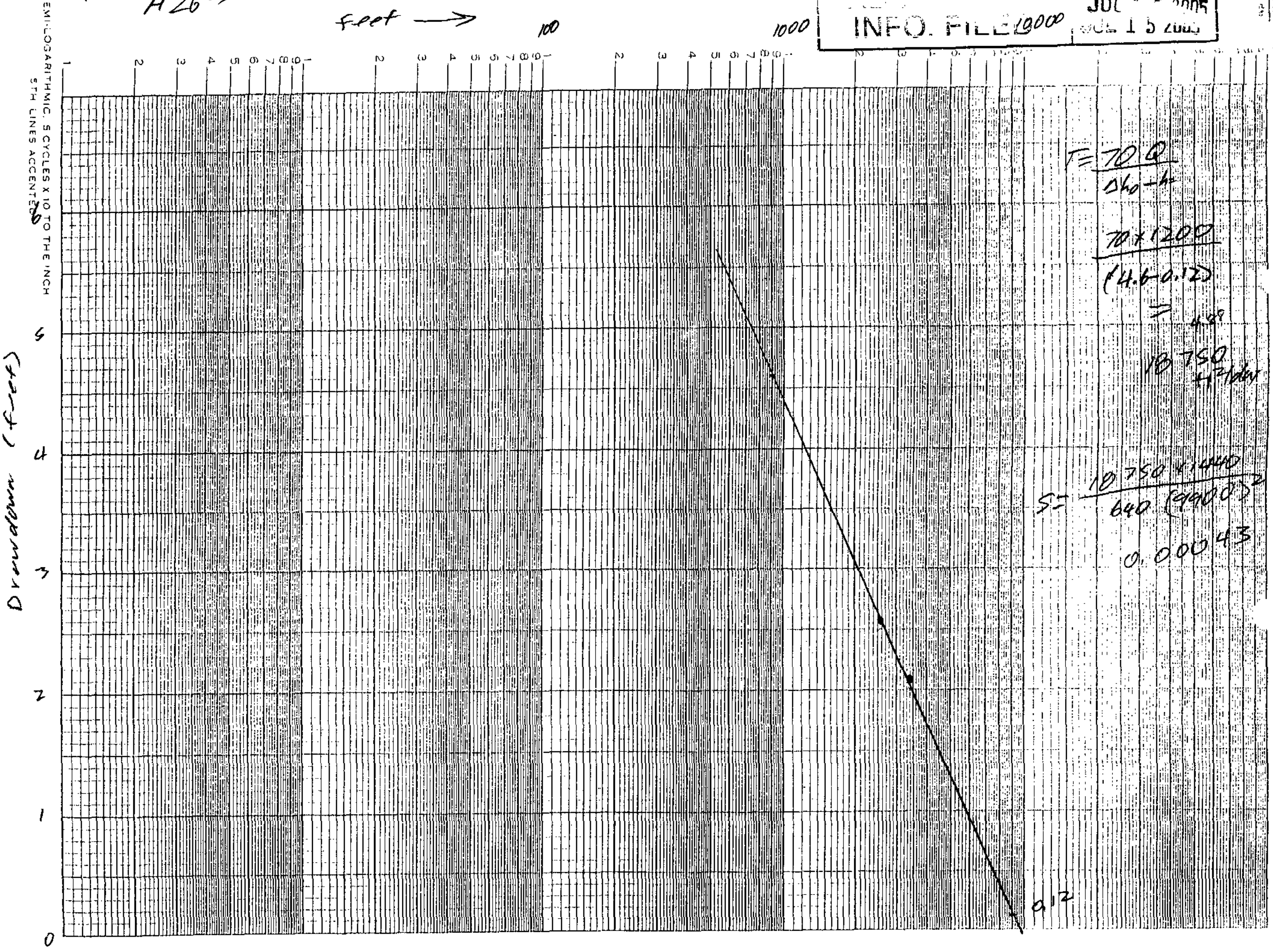
Δh_{0-h} 0.68 feet
at 68 min

$$T = \frac{15.3\,Q}{\Delta h_{0-h}} = \frac{143 \times 1200}{0.68} = 27000 \text{ ft}^2/\text{day}$$

$$S = \frac{27000 \times 68 \times 1}{360 (3350)^2} = 0.00045$$

H26-3

Distance - Drawdown

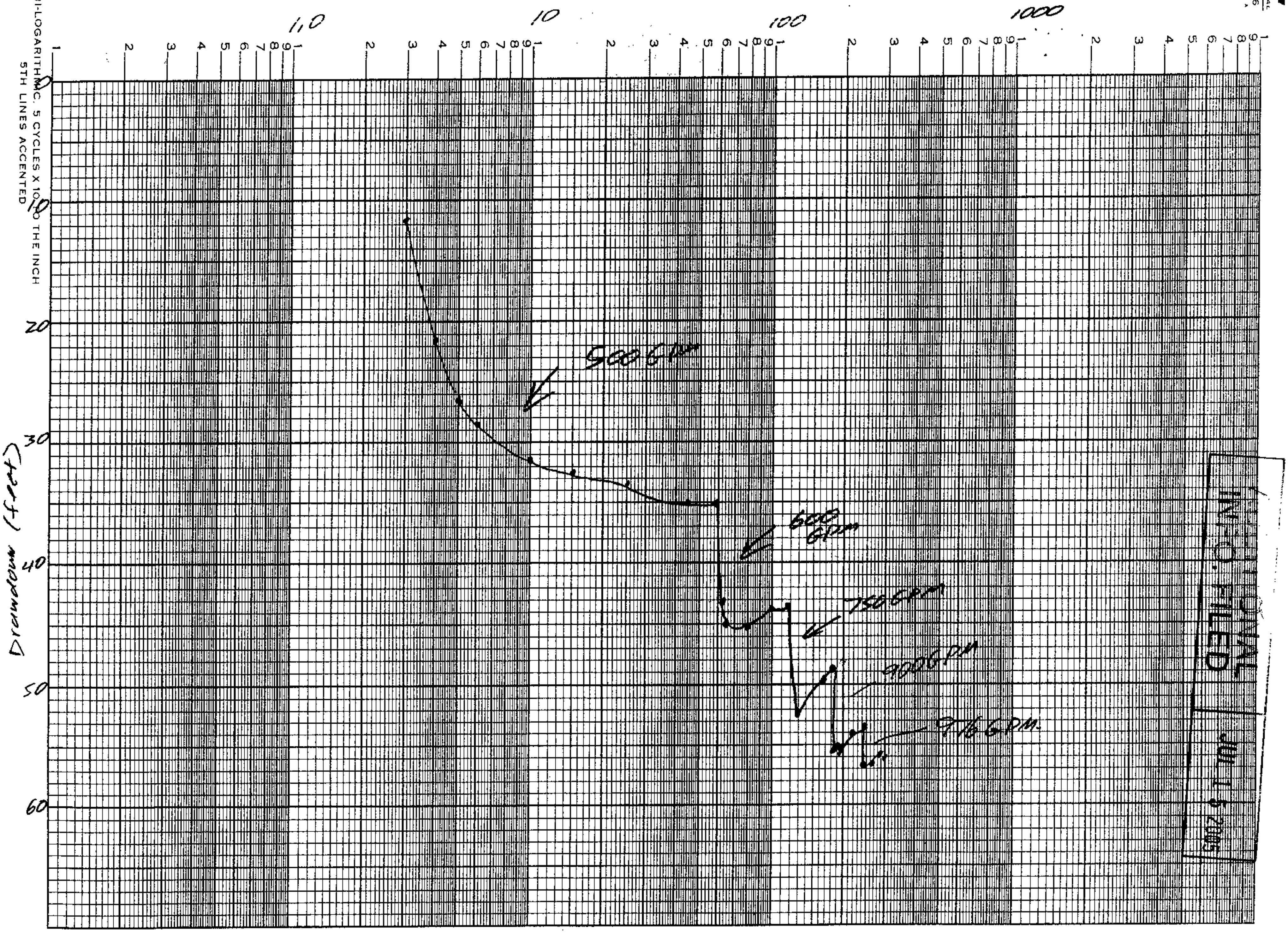


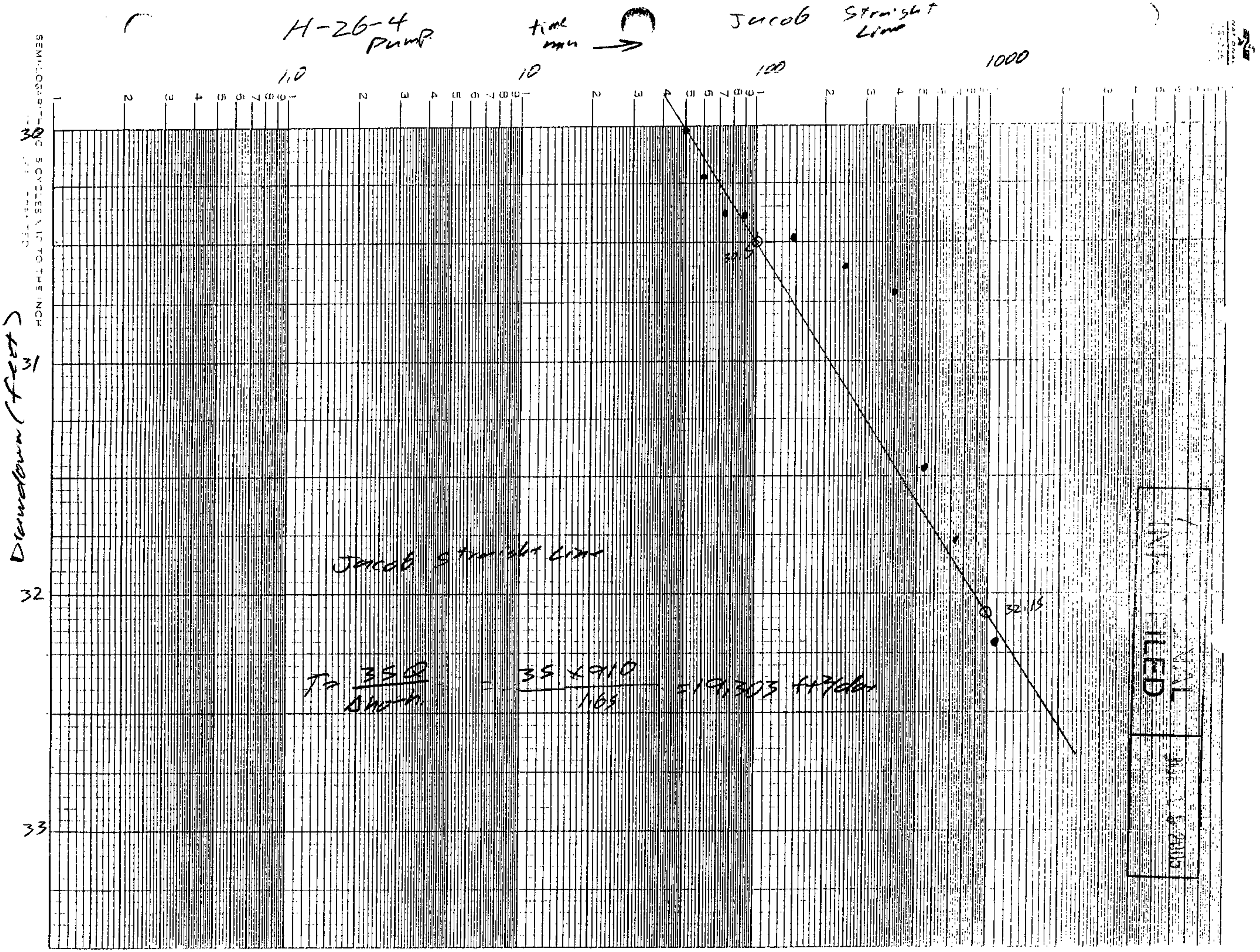
PUMP TEST DATA

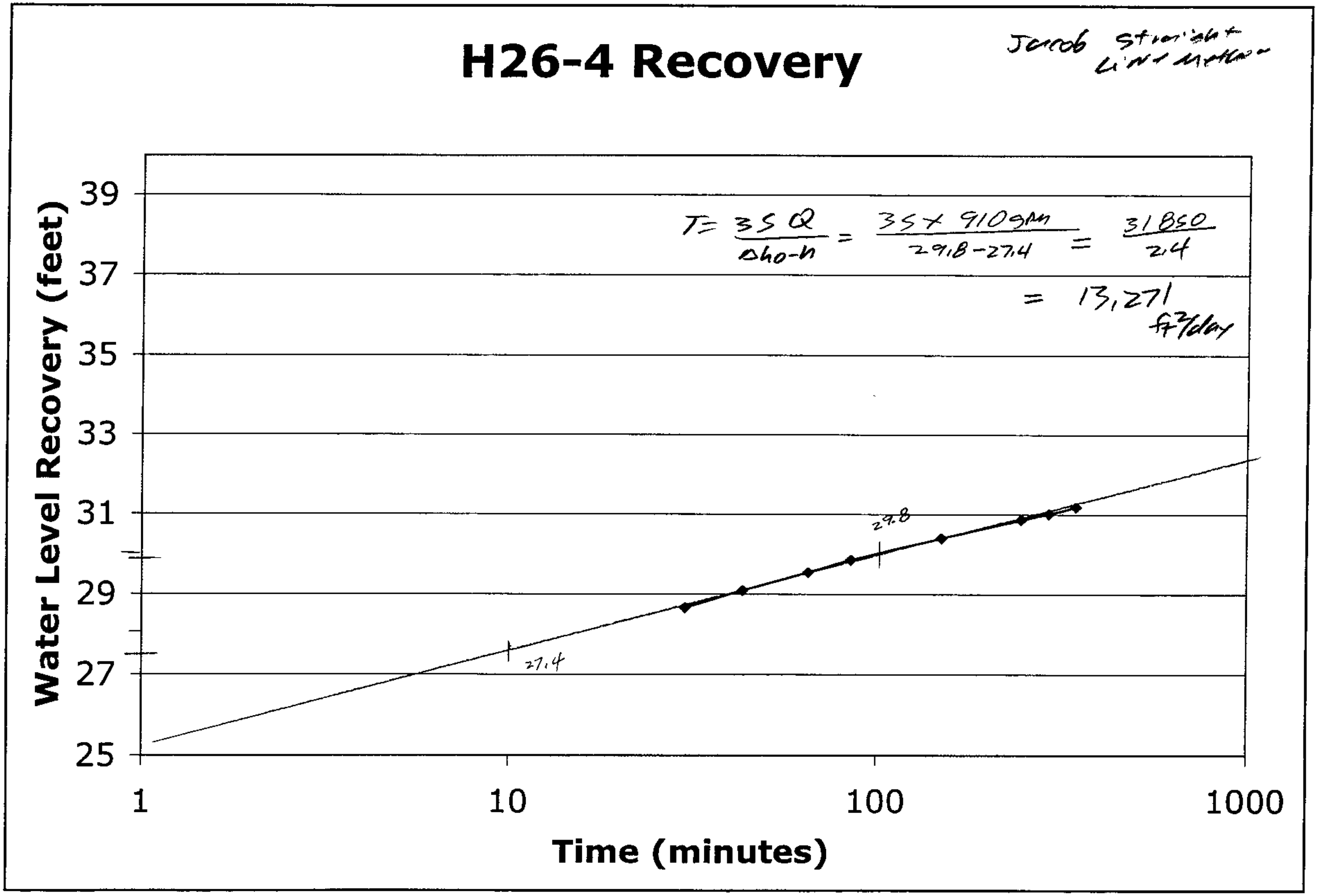
SIDNEY WELL H26-4

STEP/EFFICIENCY TEST
H26-4 PUMPING DATA
H26-4 RECOVERY DATA
H26-1 PUMPING DATA
H26-1 RECOVERY DATA
H26-3 PUMPING DATA
H26-3 RECOVERY DATA
H26-2 PUMPING DATA
H26-5 PUMPING DATA
H26-4 DISTANCE-DRAWDOWN ANALYSIS

H26-4 step test




H-26-4 pump
time min →
Jacob Straight Line
1.0
10
100
1000
Drawdown (feet)
30
31
32
33
32.15
Jacob Straight Line
T = 35Q / Δh
= 35 × 910 / 165
= 19,303 ft²/day
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
FILED


H26-4 Recovery
Jacob Straight Line Method
T= 35 Q / Δho-h = 35 × 910 gpm / 29.8-27.4 = 31850 / 2.4
= 13,271 ft²/day
29.8
27.4
Water Level Recovery (feet)
39
37
35
33
31
29
27
25
1
10
100
1000
Time (minutes)

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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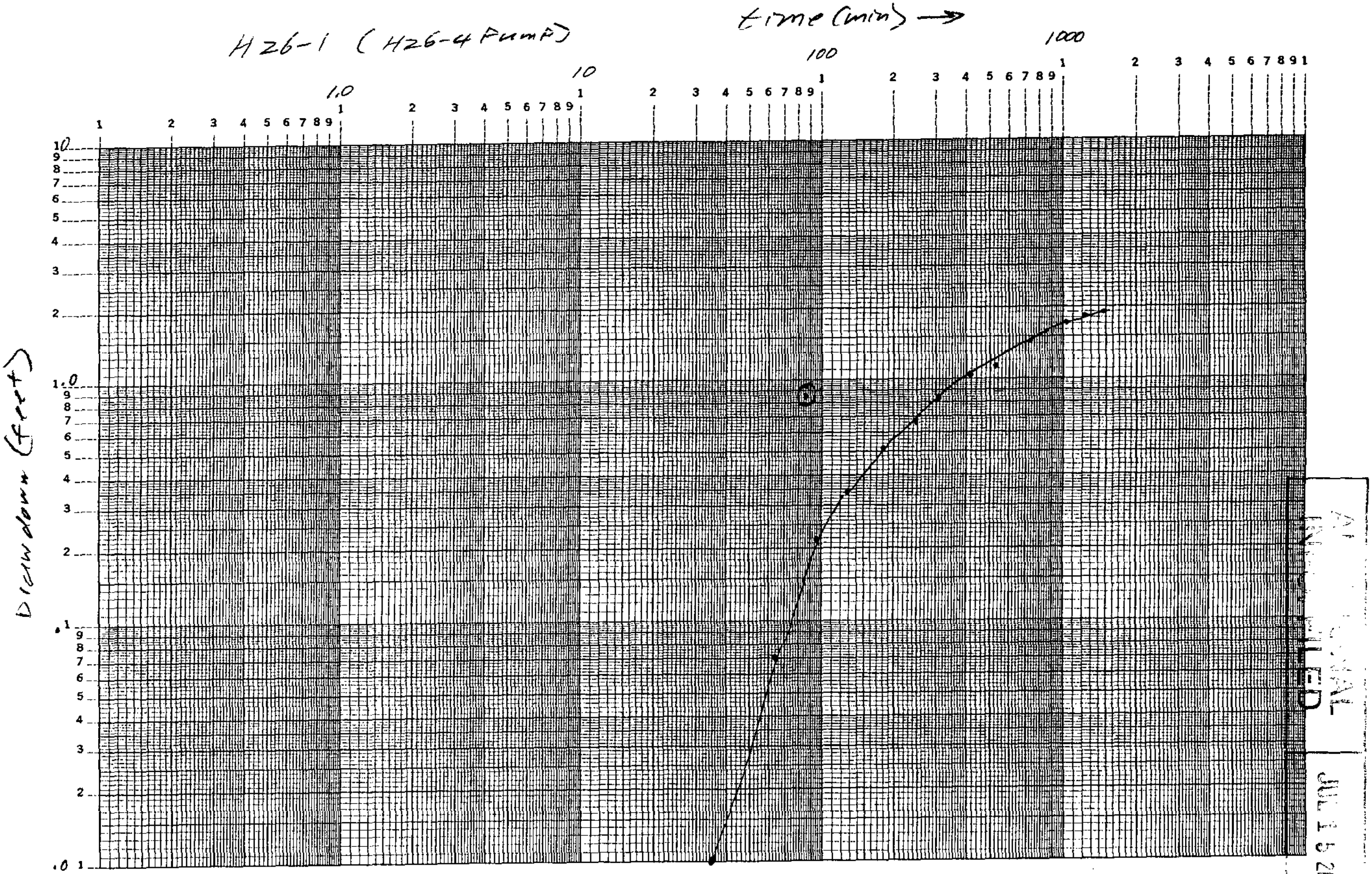

$\Delta h_{o-h} = 0.85'$

$\Delta t = 88$ min

$$T = \frac{15.3 \times Q \times 1}{\Delta h_{o-h}} = \frac{15.3 \times 910 \times 1}{0.85} = 16{,}380 \text{ ft}^2/\text{day}$$

$$S = \frac{T t u}{360 \times r^2} = \frac{16380 \times 88 \times 1}{360\,(3800)^2} = 0.00028$$

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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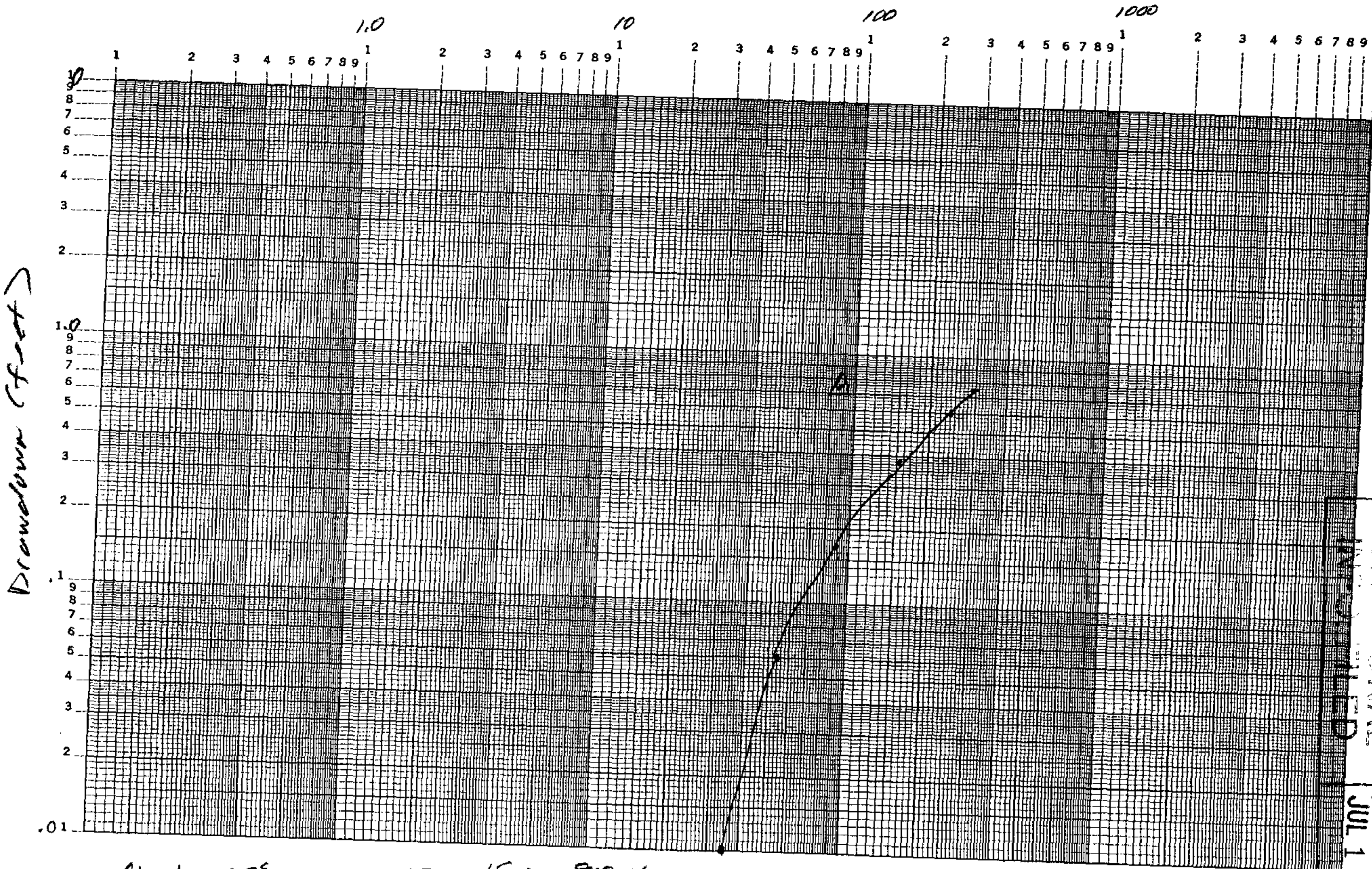
H26-1 (H26-4 Recovery)



$\Delta h_{0-h} = 0.75$
$t = 88\text{ min}$

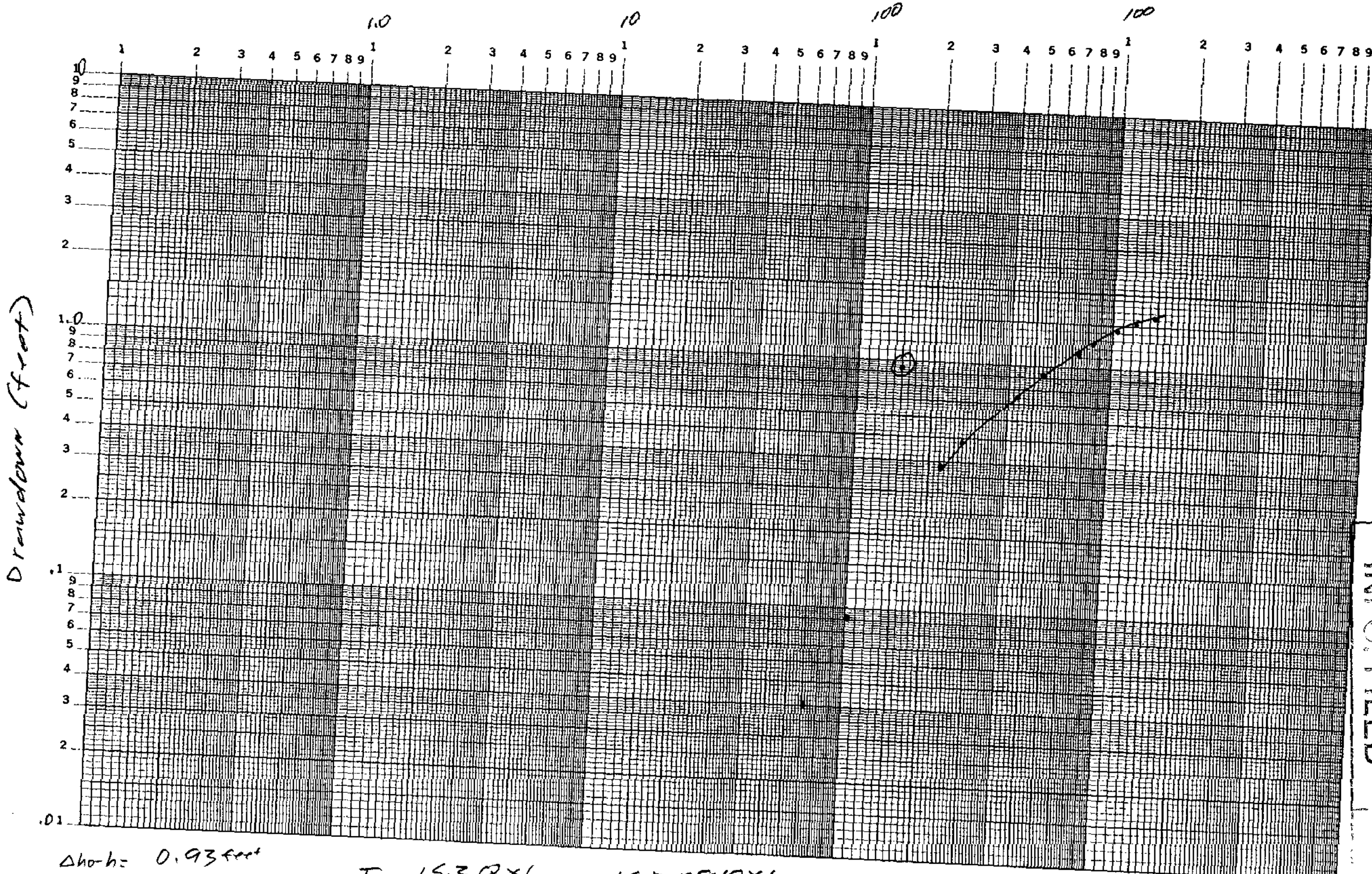
$$T = \frac{15.3 \times 910 \times 1}{0.75} = 18564 \text{ ft}^2/\text{day}$$

$$S = \frac{18564 \times 88 \times 1}{360\,(3800)^2} \quad 0.00031$$

46 7520

H26-3 (H26-4 Pump)

time → min.



$\Delta h_0 - h = 0.93$ feet

$\Delta t = 150$ m.

$$T = \frac{15.3\,Q \times 1}{\Delta h_0 - h} = \frac{15.3 \times 910 \times 1}{0.93} = 14971 \text{ ft}^2/\text{day}$$

$$S = \frac{T\,t\,u}{360\,(r)^2} = \frac{14971 \times 150 \times 1}{360 \times (4900)^2} = 0.00026$$

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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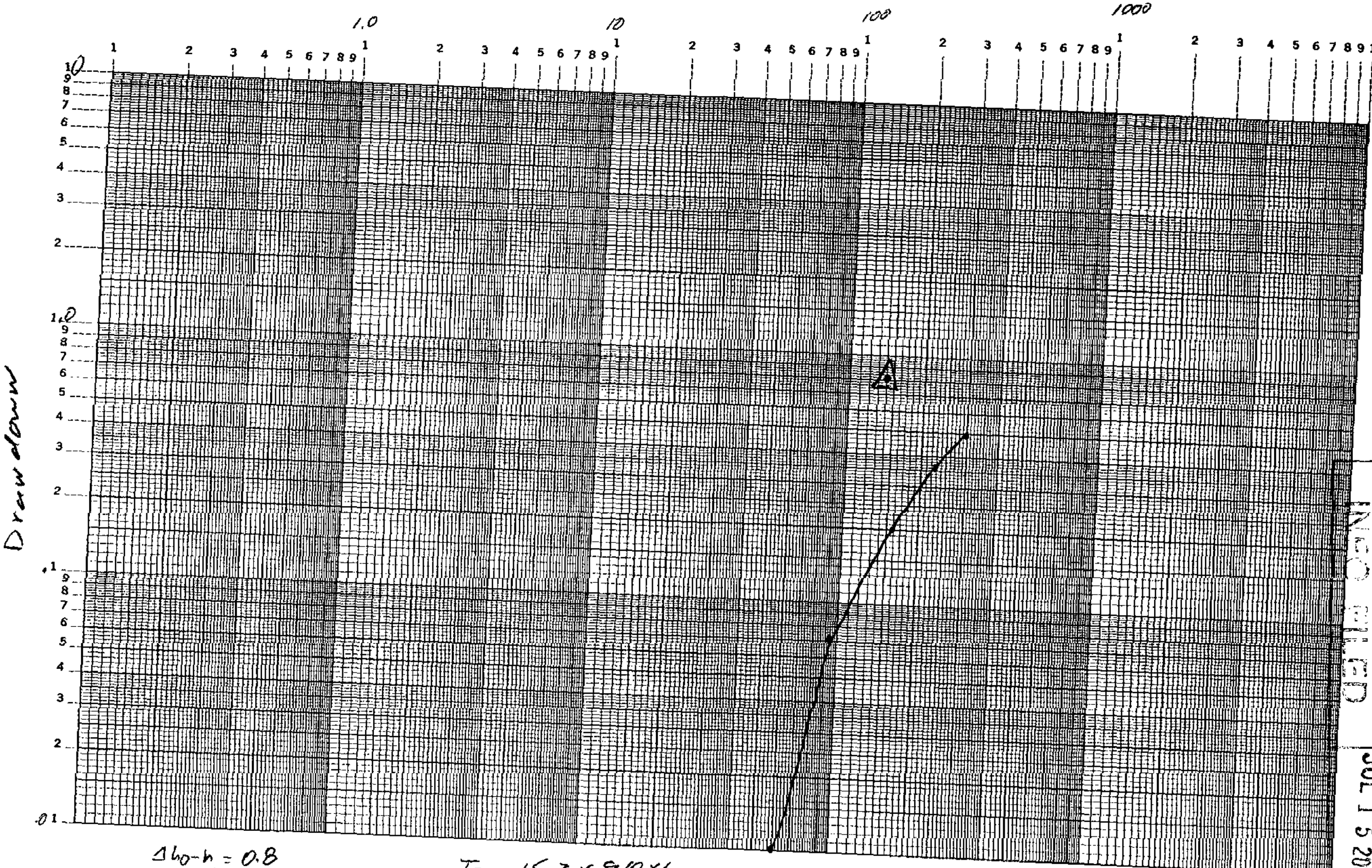
H 26-3 (H26-4 Recovery)



$\Delta h_0 - h = 0.8$
$t = 140$

$$T = \frac{15.3 \times 910 \times 1}{0.8} = 17{,}404 \ \text{ft}^2/\text{day}$$

$$S = \frac{17404 \times 140 \times 1}{360\,(4900)^2} = 0.00028$$

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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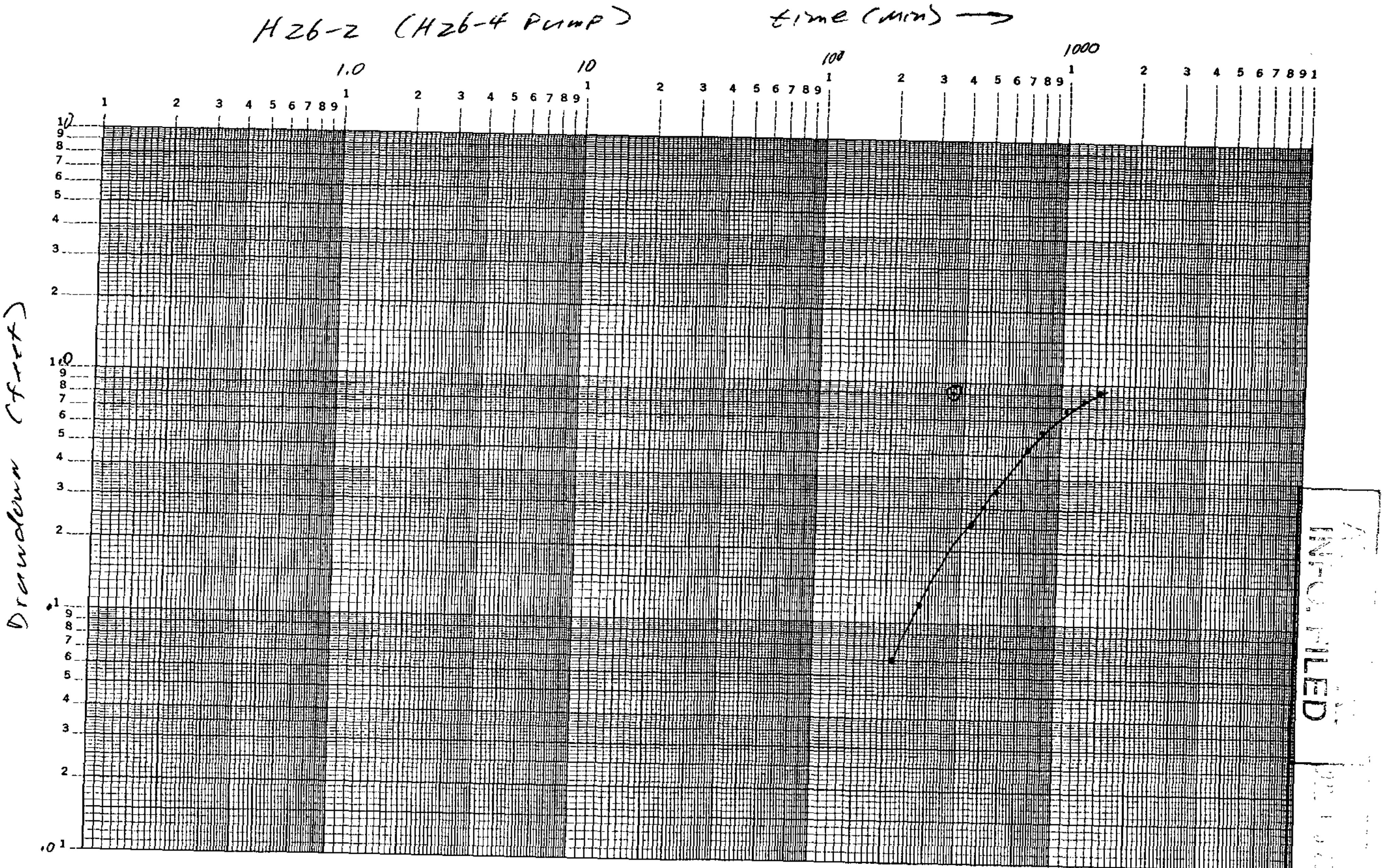

$\Delta h_0 - h = 0.90$ feet

$\Delta t = 360$ min

$$T = \frac{15.3 \times Q \times 1}{\Delta h_0 - h} = \frac{15.3 \times 910 \times 1}{0.90} = 15470 \text{ ft}^2/\text{day}$$

$$S = \frac{T t u}{360 r^2} = \frac{15470 \times 360 \times 1}{360 \; (6100)^2} = 0.00042$$

K•E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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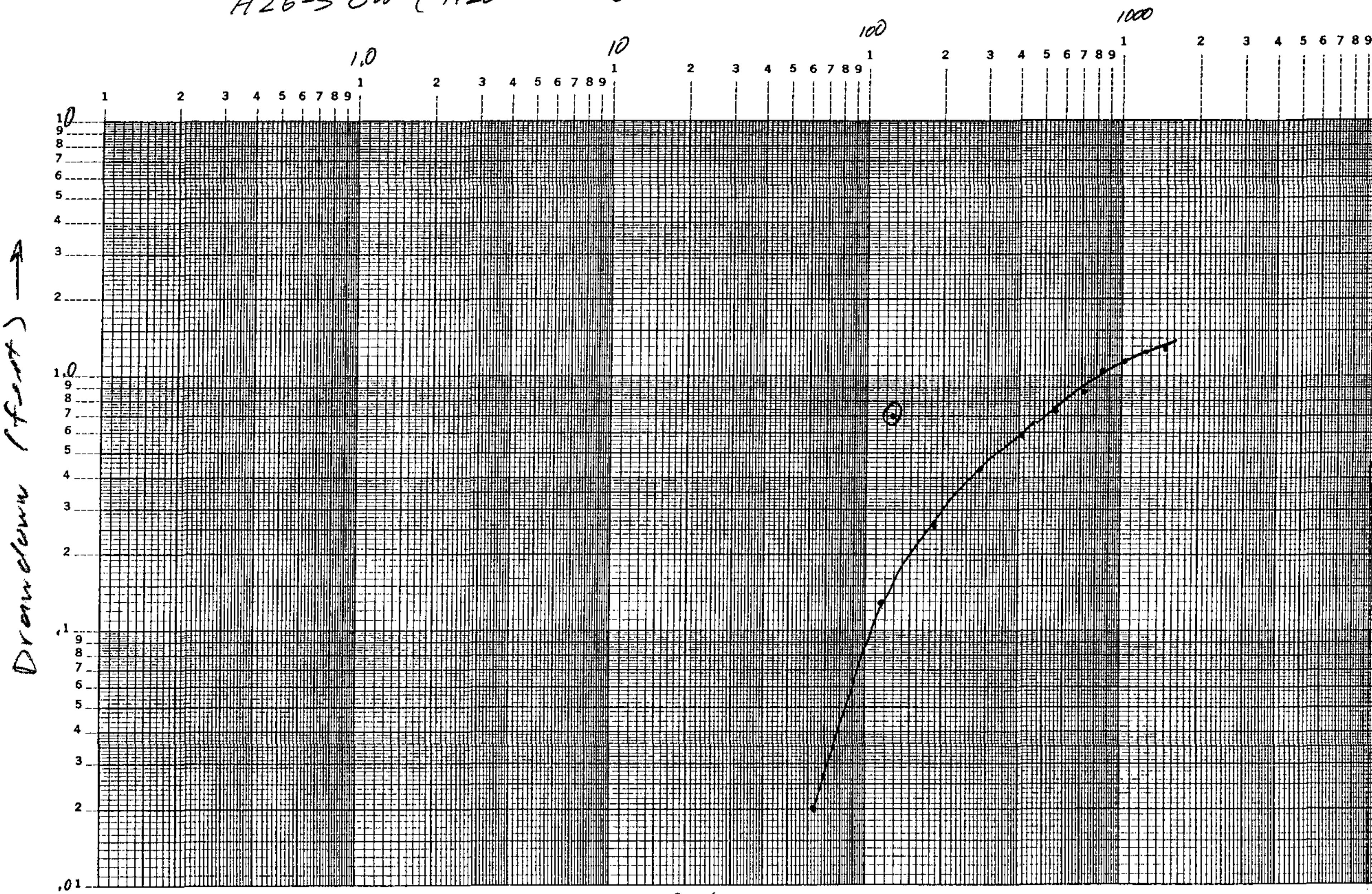
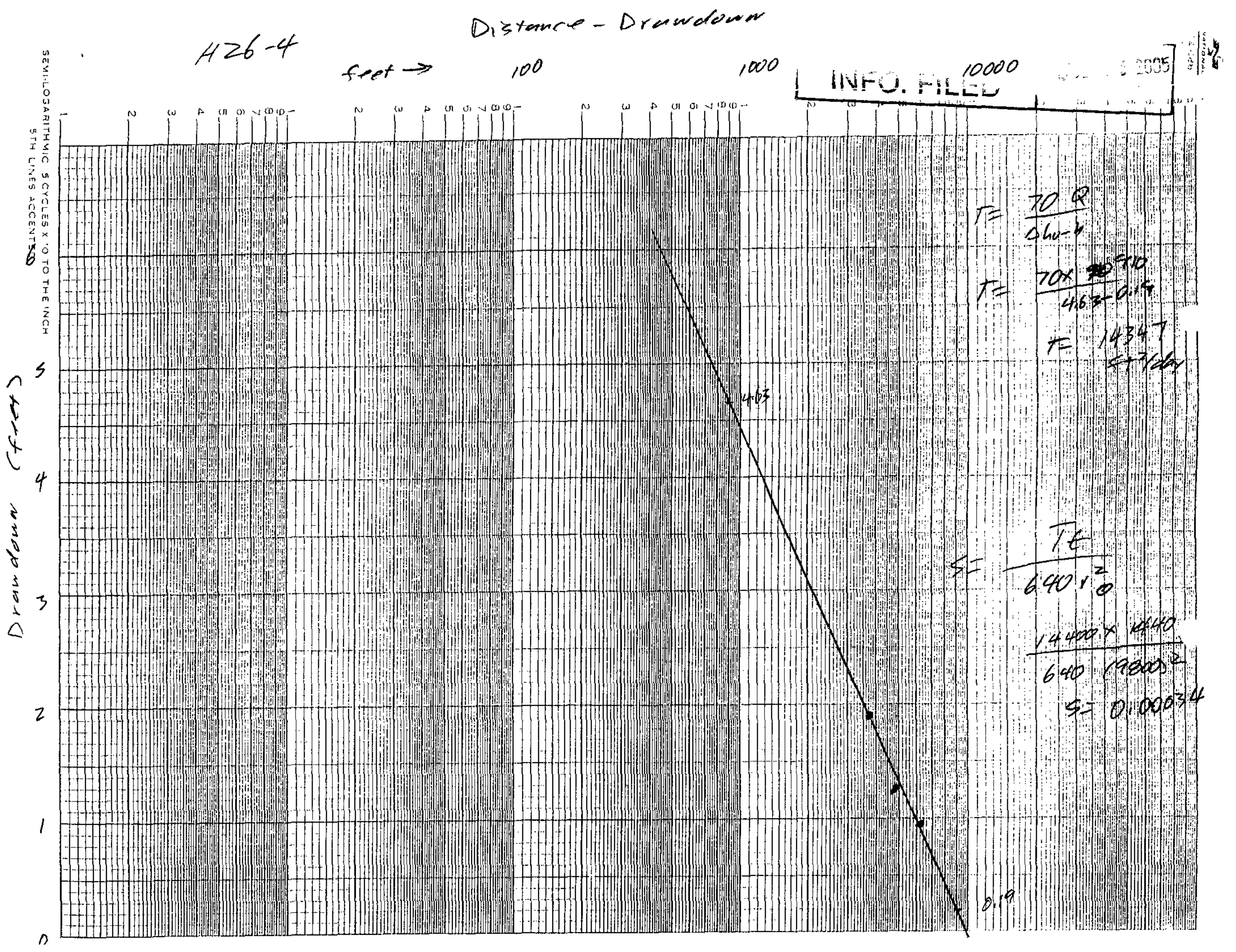
H26-S OW (H26-4 Pump)



Shown = 0.69
at 128 min

$$T = \frac{15.3 \times 910 \times 1}{0.69} = 20,178 \text{ ft}^2/\text{day}$$

$$S = \frac{20,178 \times 128 \times 1}{360 (4900)^2} \quad 0.0003$$

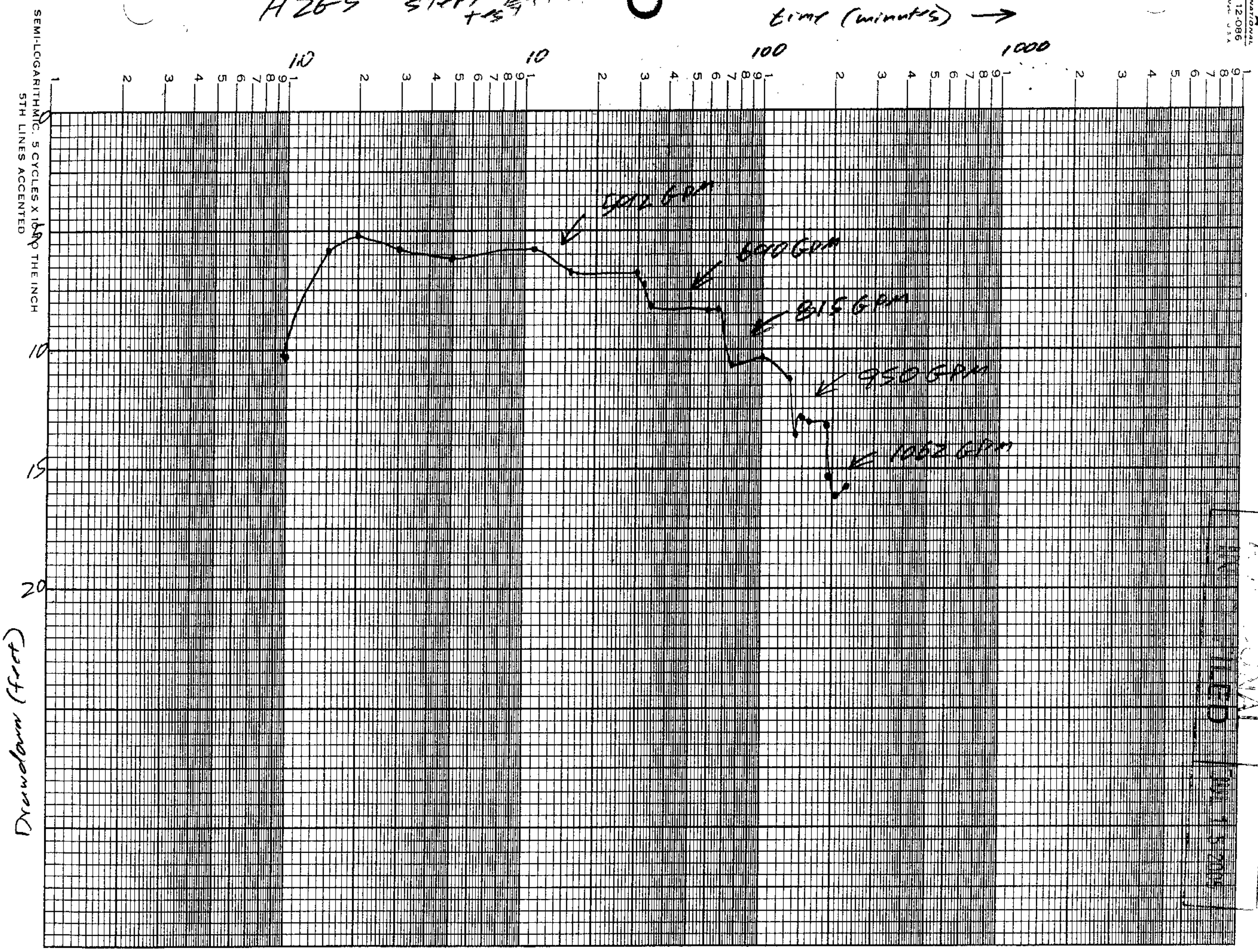

Distance - Drawdown
H26-4
feet →
100
1000
10000
INFO. FILED
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
5TH LINES ACCENTED
Drawdown (feet)
0
1
2
3
4
5
6
4.63
0.19
T = 70 Q / Δh-l
T = 70 x 910 / 4.63 - 0.19
T = 14347 ft²/day
S = Tt / 640 r₀²
14400 x 1440 / 640 (9800)²
S = 0.00034

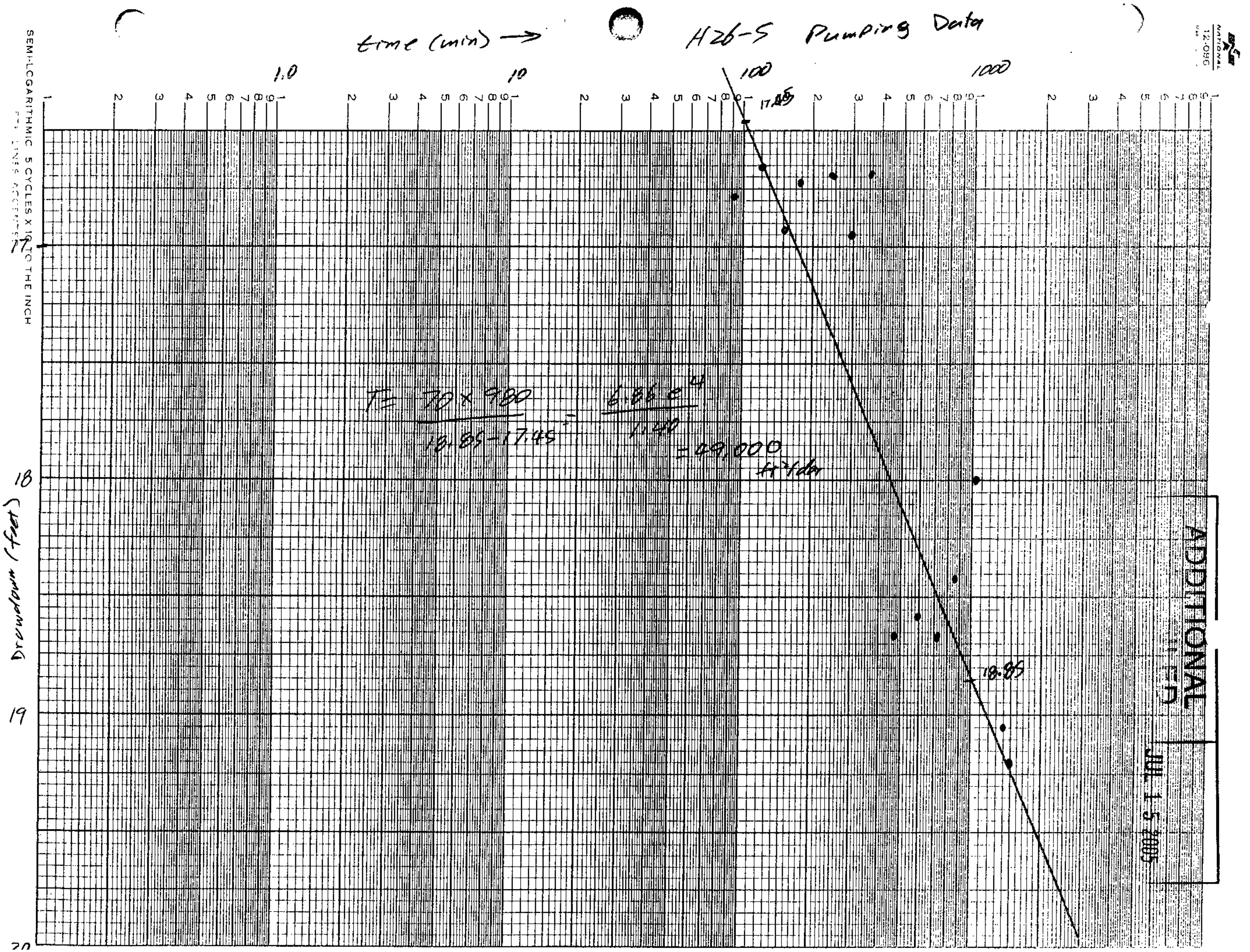
PUMP TEST DATA

SIDNEY WELL H26-5

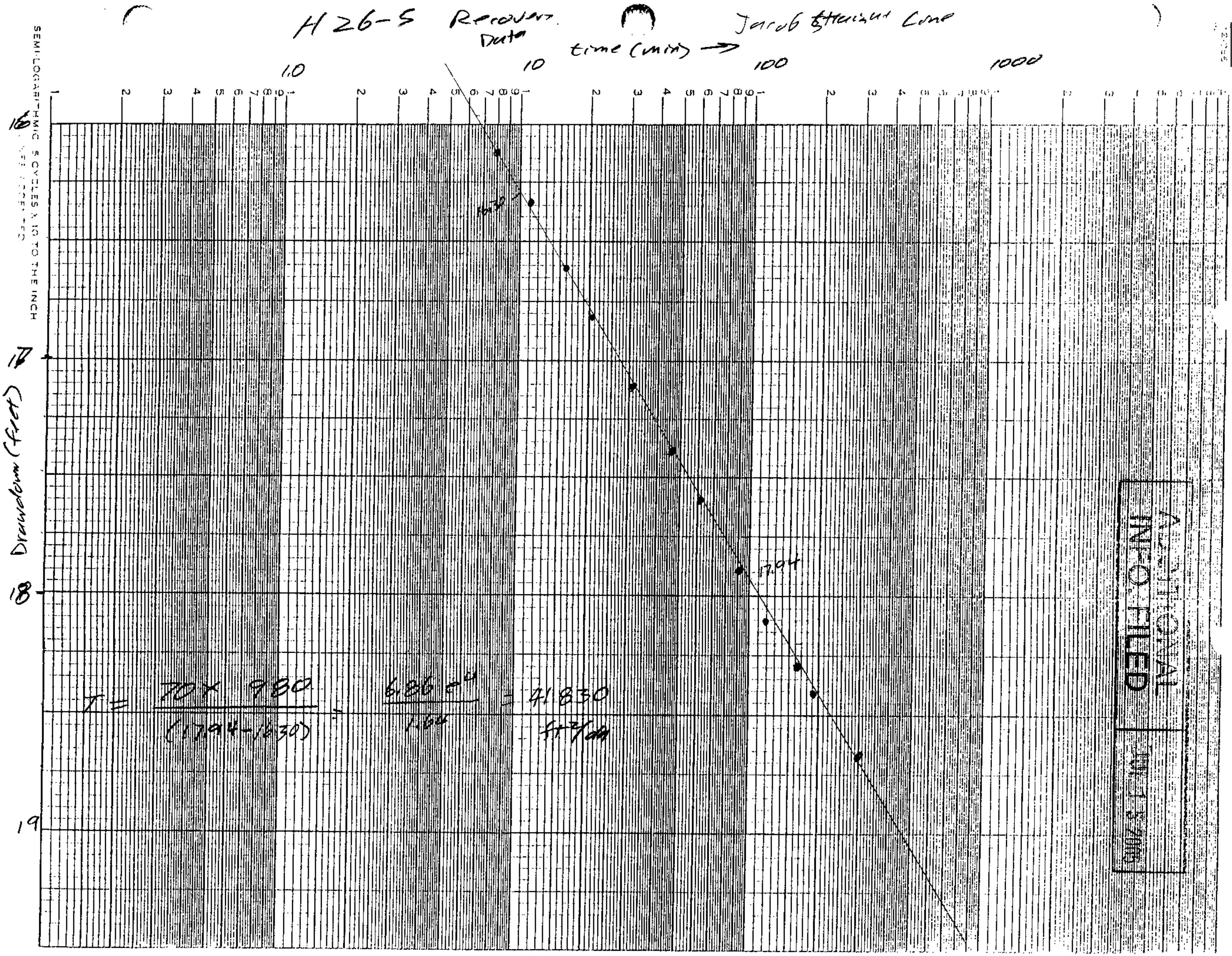
STEP/EFFICIENCY TEST
H26-5 PUMPING DATA
H26-5 RECOVERY DATA
H26-1 PUMPING DATA
H26-1 RECOVERY DATA
H26-5 (OW) PUMPING DATA
H26-5 (OW) RECOVERY DATA
SOUTH WATER SUPPLY WELL PUMPING DATA
H26-5 DISTANCE-DRAWDOWN ANALYSIS

H26-5 step/efficiency test



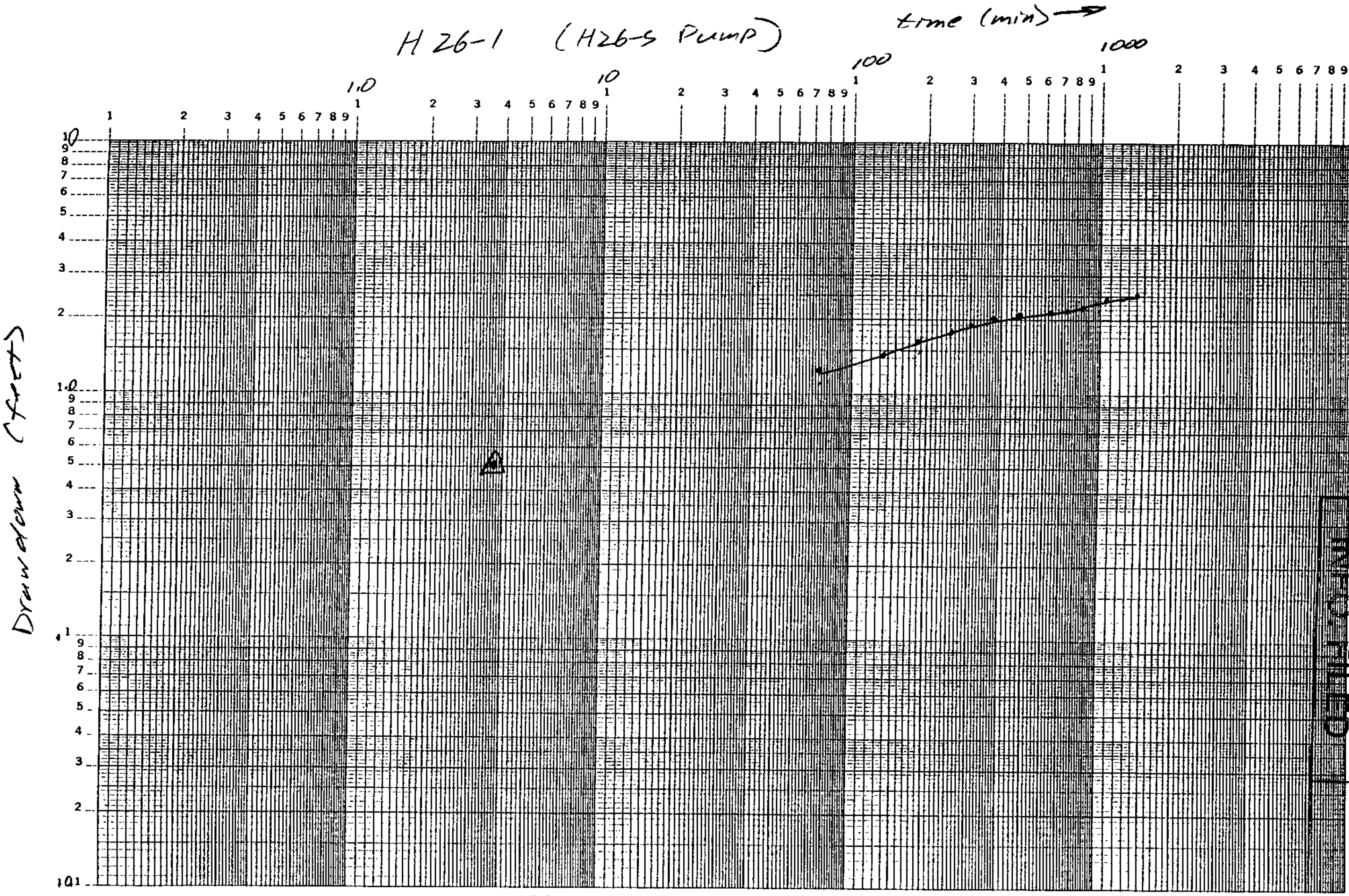


H26-S Pumping Data
time (min) →
1.0
10
100
1000
Drawdown (feet)
17
18
19
20
17.45
18.85
T = 70 × 980 / (18.85 − 17.45) = 6.86 e4 / 1.40 = 49,000 ft²/day
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
NATIONAL 12-096


H26-5 Recovery Data
Jacob Straight Line
time (min) →
1.0
10
100
1000
Drawdown (feet)
16
17
18
19
16.30
17.94
T = 70 × 980 / (17.94-16.30) = 6.86 e4 / 1.64 = 41830 ft²/d
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH

K+E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7520

H 26-1 (H26-S Pump)



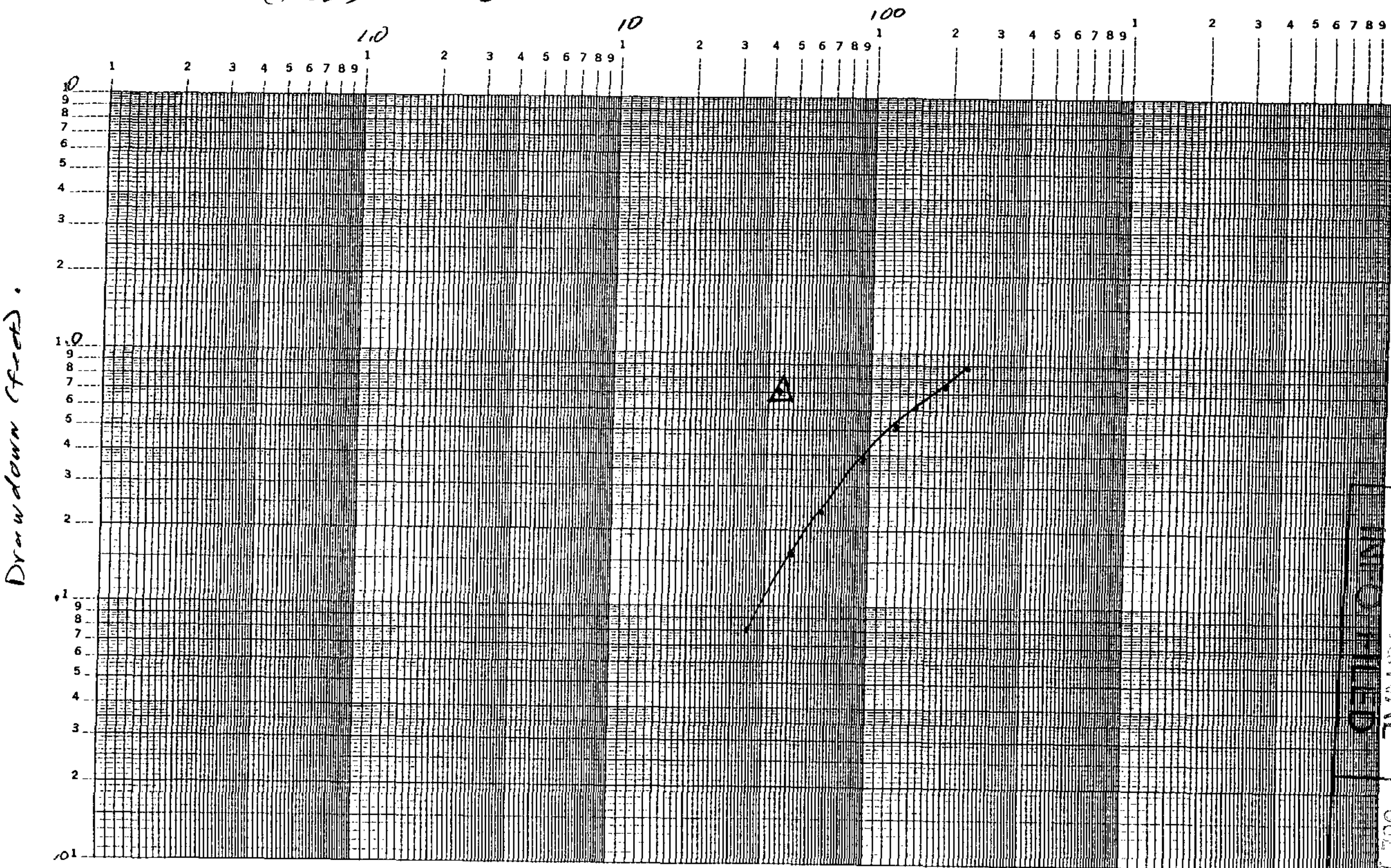
$\Delta h_0 - h = 0.50$ ft

$\Delta t = 3.7$ min

$$T = \frac{15.3 \times 985}{0.5} = 30141 \text{ ft}^2/\text{day}$$

$$S = \frac{30141 \times 3.7 \times 1}{360\ (3500)^2} = 0.000025$$

H26-1 (H26-5 Recovery)



$\Delta h_o - h = 0.7$

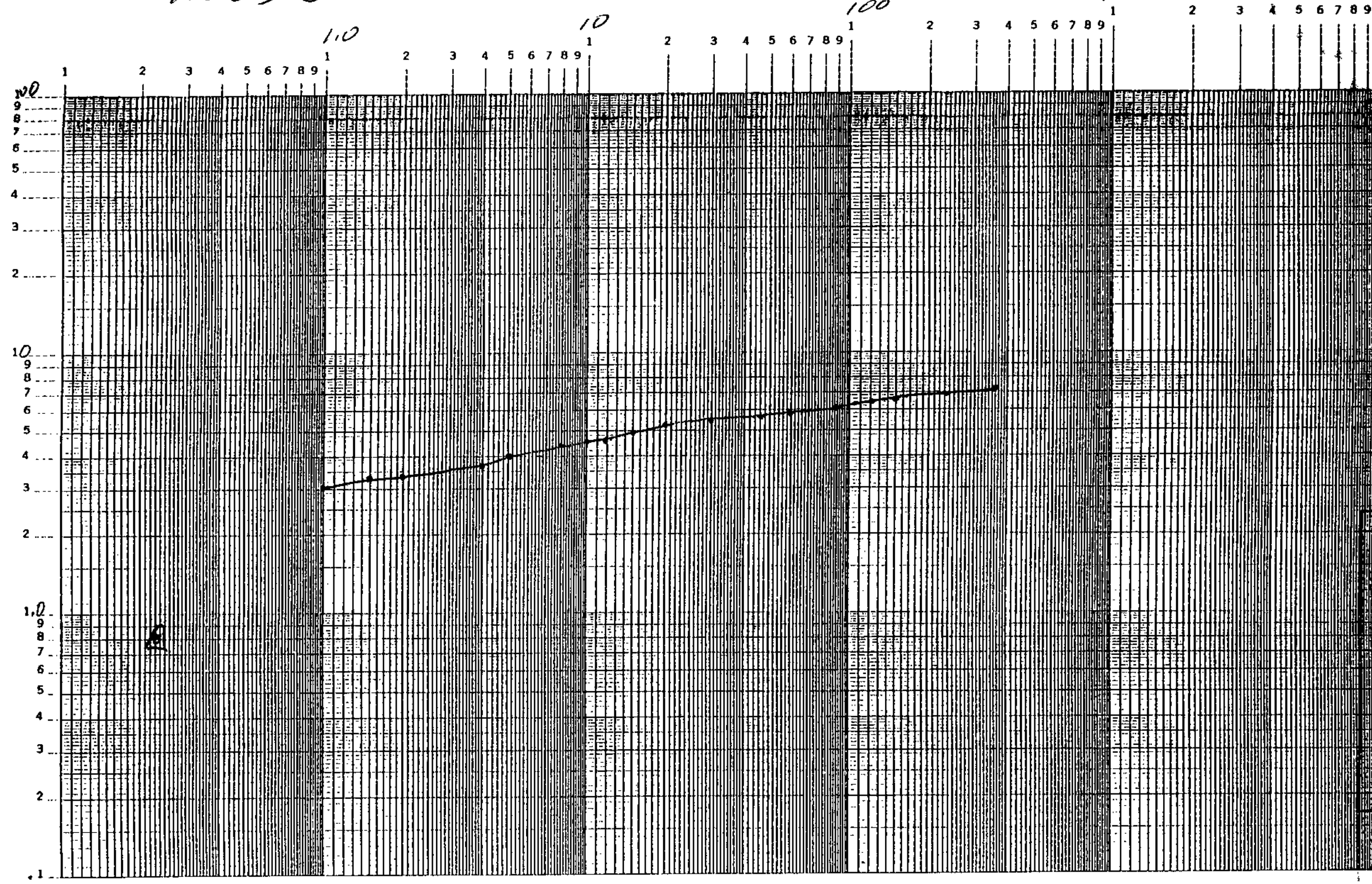
$\Delta t = 44$ min

$$T = \frac{15.3\,Q}{\Delta h_o - h} = \frac{15.3 \times 985}{0.7} = 21{,}530 \text{ ft}^2/\text{day}$$

$$S = \frac{21530 \times 44 \times 1}{360\,(3500)^2} = 0.000215$$

K•E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7520

H26-S OW (26-S Pumping)



$\Delta h_{o-h} = 0.80$

$t = 0.28$

$T = \frac{15.3 Q}{\Delta h_{o-h}} = \frac{15.3 \times 985}{0.80} = 18838$ ft²/day

$S = \frac{T t_1}{360 r^2} = \frac{18838 \times 0.28 \times 1}{360 (100)^2} = 0.00146$

K+E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

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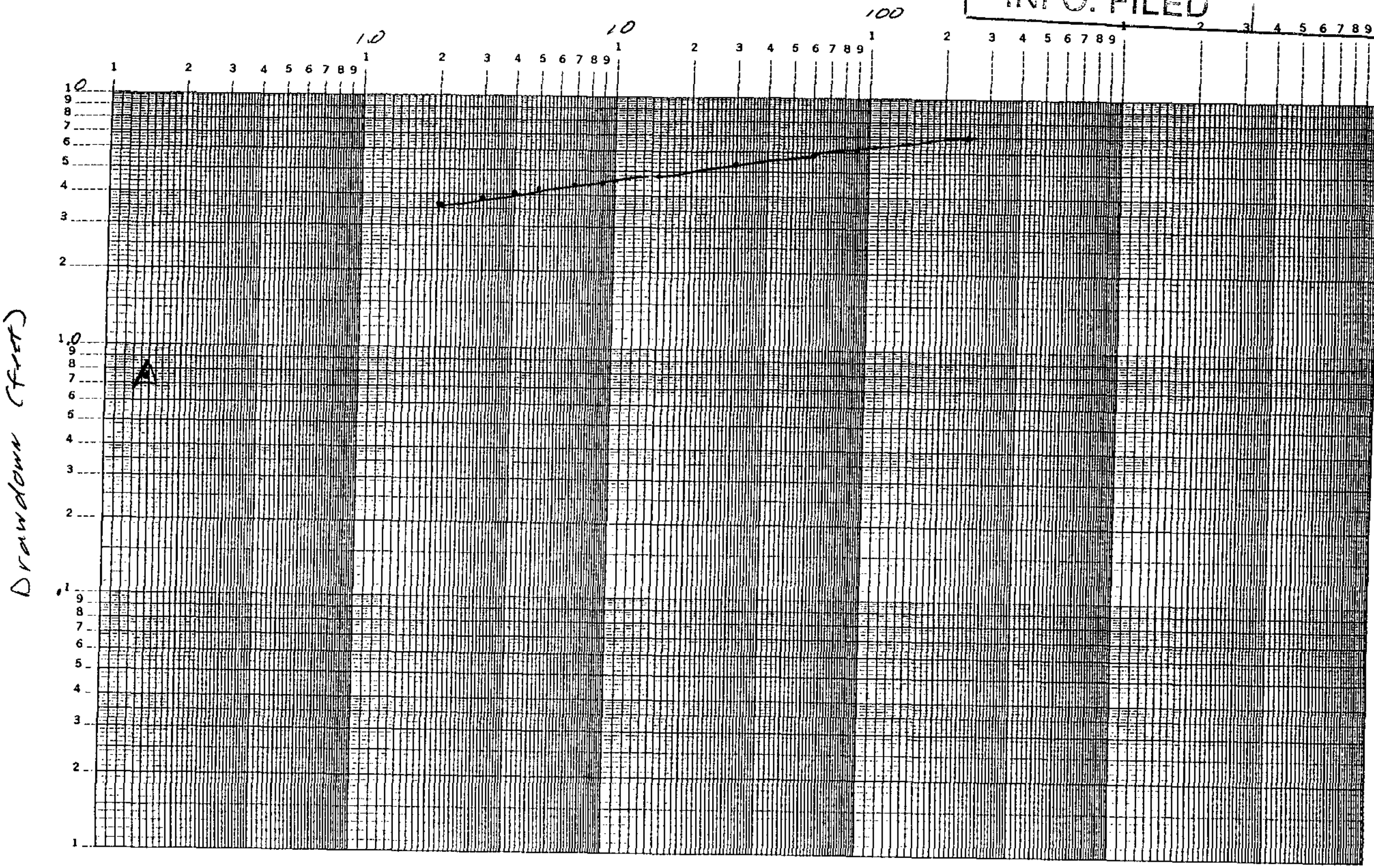
HZ6-SOW (HZ6-S Recovery)



Δh₀-h. 0.75

Δt 0.13

$$T = \frac{15.3 \times 985}{0.75} = 20,094 \text{ ft}^2/\text{day}$$

$$S = \frac{20,0?? \times 0.13 \times ?}{360 \ (100)^2} = 0.000\,73$$

K•E LOGARITHMIC 3 x 5 CYCLES
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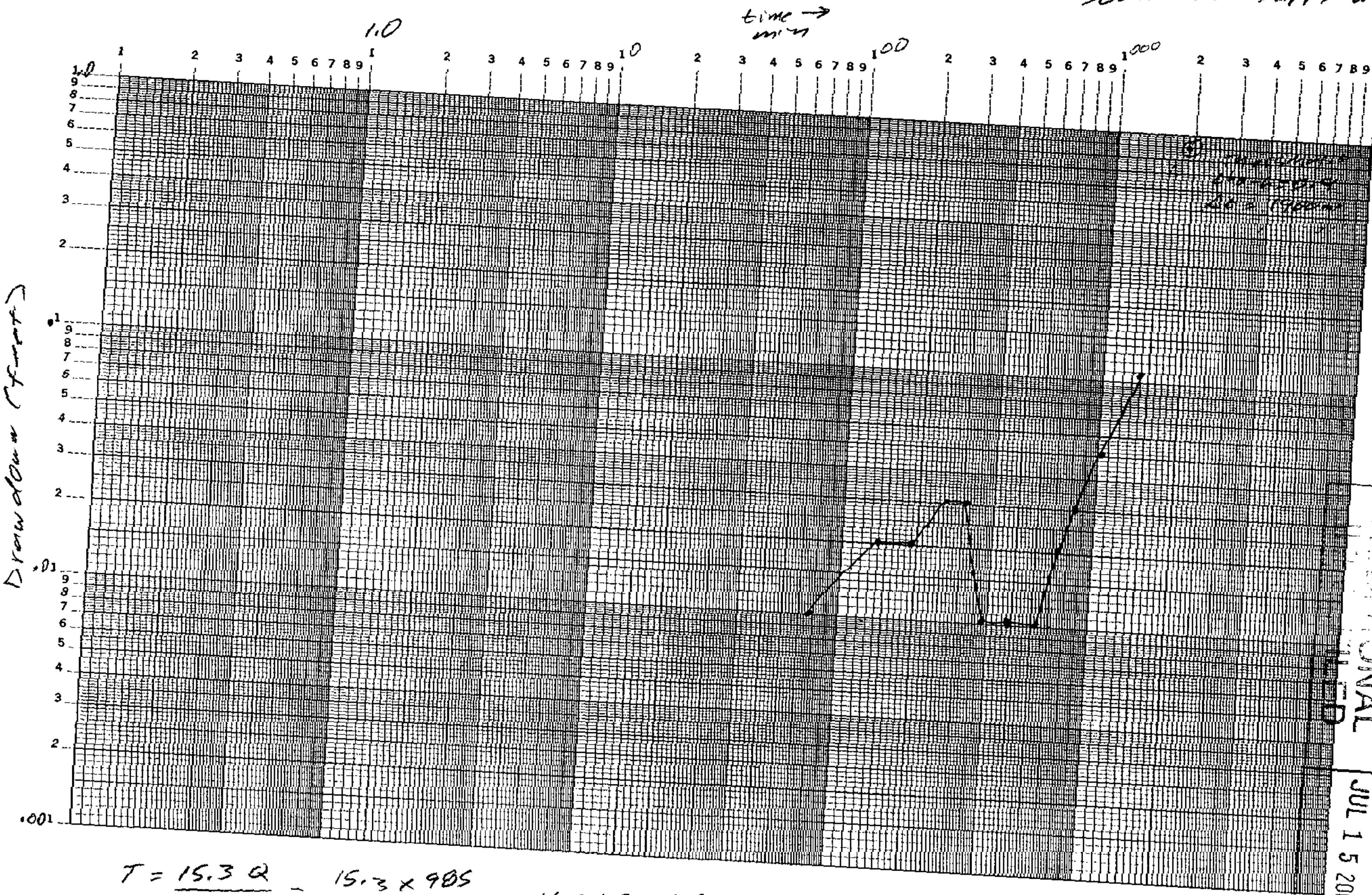
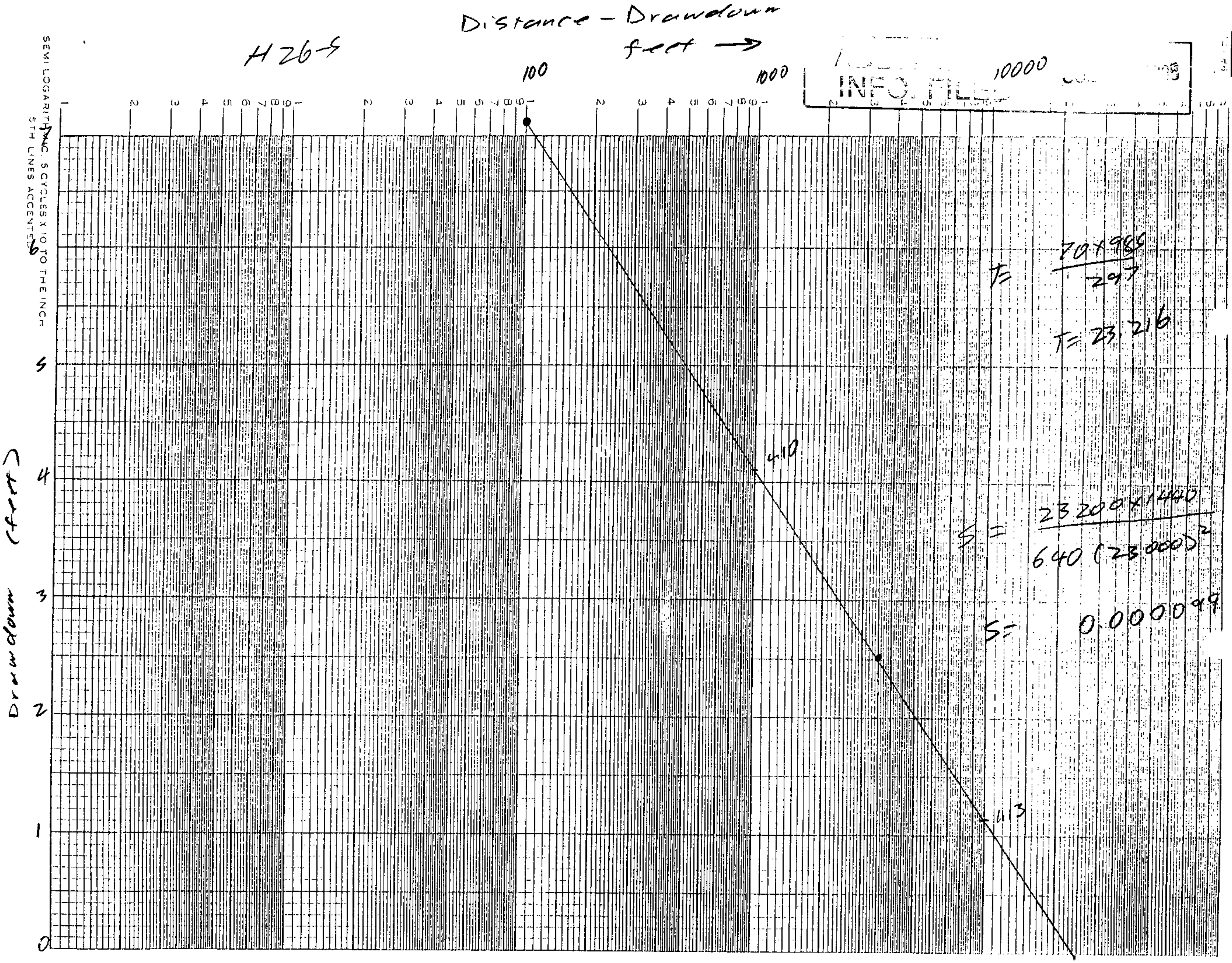
HZ6-S Pumping Data

SWS Response
South Water Supply well



$$T = \frac{15.3\,Q}{\Delta h_{o-4}} = \frac{15.3 \times 985}{0.9} = 16{,}745 \text{ ft}^2/\text{day}$$

$$S = \frac{16745 \times 1900\text{ m} \times 1}{360\,(4600')^2} = 0.0042$$



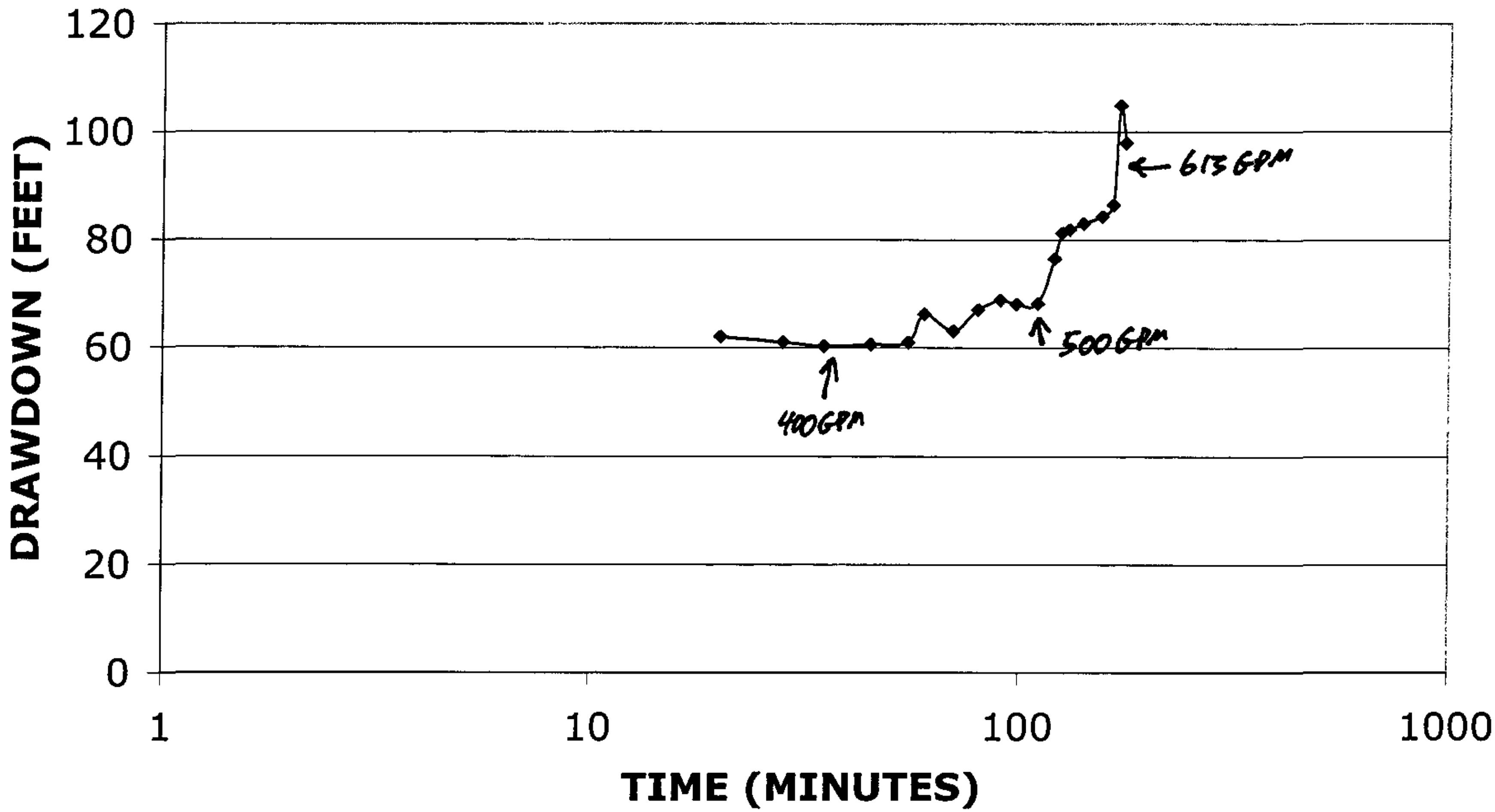
Distance - Drawdown
H26-5
feet →
100
1000
10000
INFO. FILE
SEMI LOGARITHMIC 5 CYCLES X 10 TO THE INCH
5TH LINES ACCENTED
Drawdown (feet)
6
5
4
3
2
1
0
410
113
T = 70 × 986 / 297
T = 23,216
S = 23200 × 1440 / 640 (23,000)²
S = 0.000099

PUMP TEST DATA

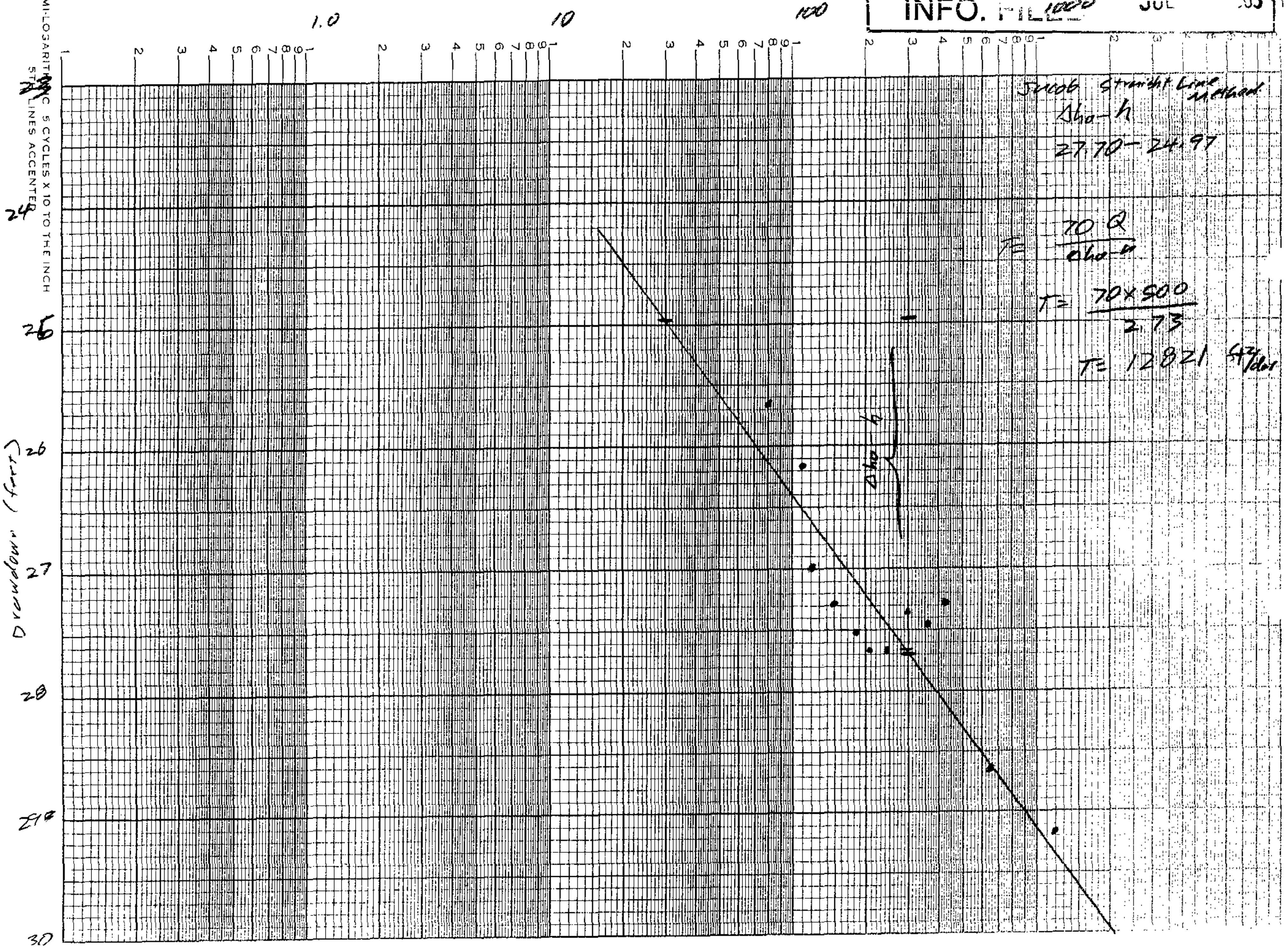
SIDNEY WELL H33-1

STEP/EFFICIENCY TEST
H33-1 PUMPING DATA
H33-2 (OW) PUMPING DATA (SHORT TEST)
H33-2 (OW) PUMPING DATA

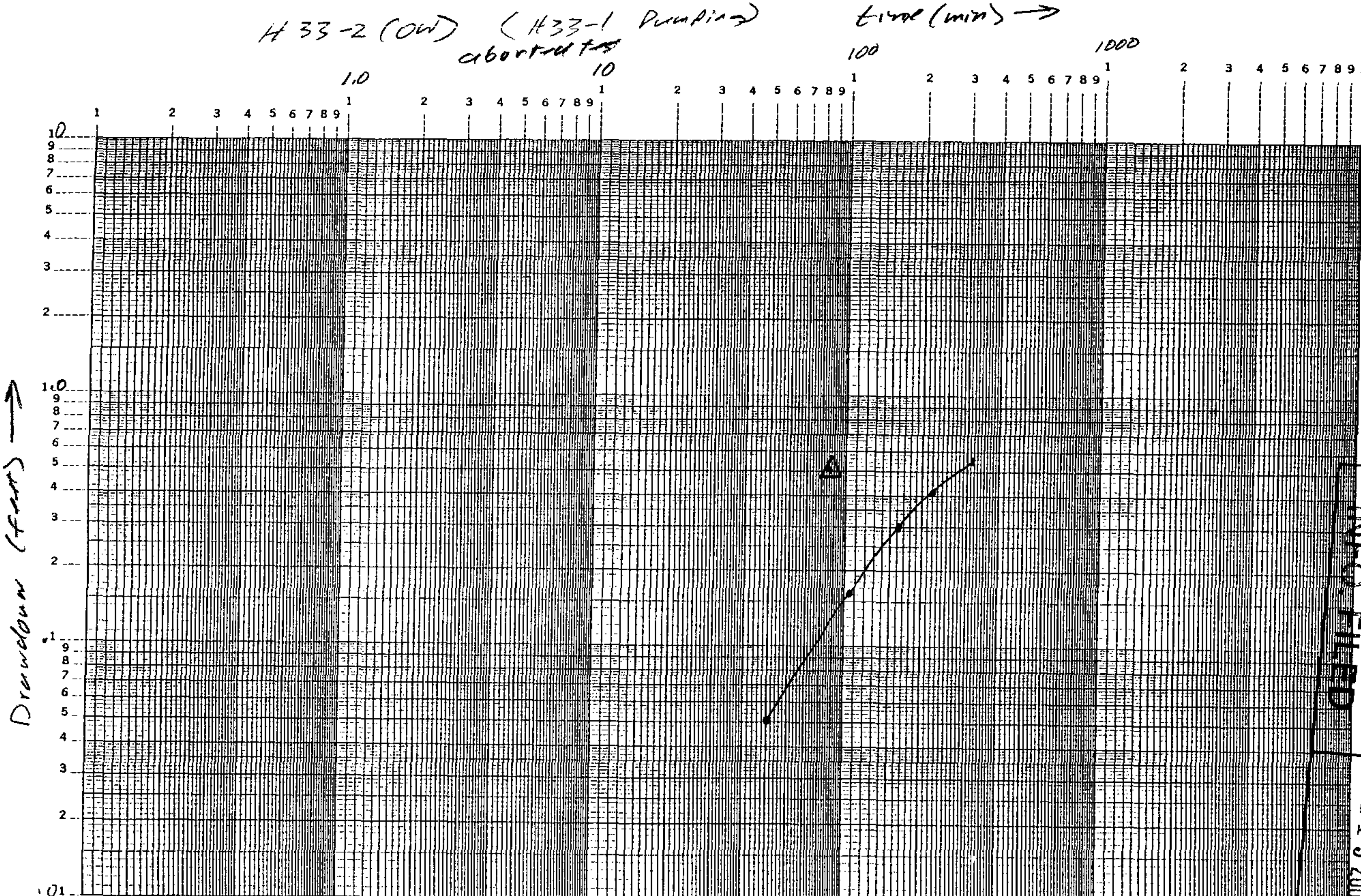
SIDNEY WELL H33-1
STEP/EFFICIENCY TEST



H33-1 Pumping



H 33-2 (OW) (H33-1 Pumping) aborted



$\Delta h_{0-h} = 0.5'$

$\Delta t = 76$ min

$$T = \frac{15.3\, Q \times 1}{\Delta h_{0-h}} = \frac{15.3 \times 500 \times 1}{0.5} = 15300 \text{ ft}^2/\text{day}$$

$$S = \frac{15300 \times 76 \times 1}{360(3100)^2} = 0.00034$$

K&E LOGARITHMIC 3 × 5 CYCLES
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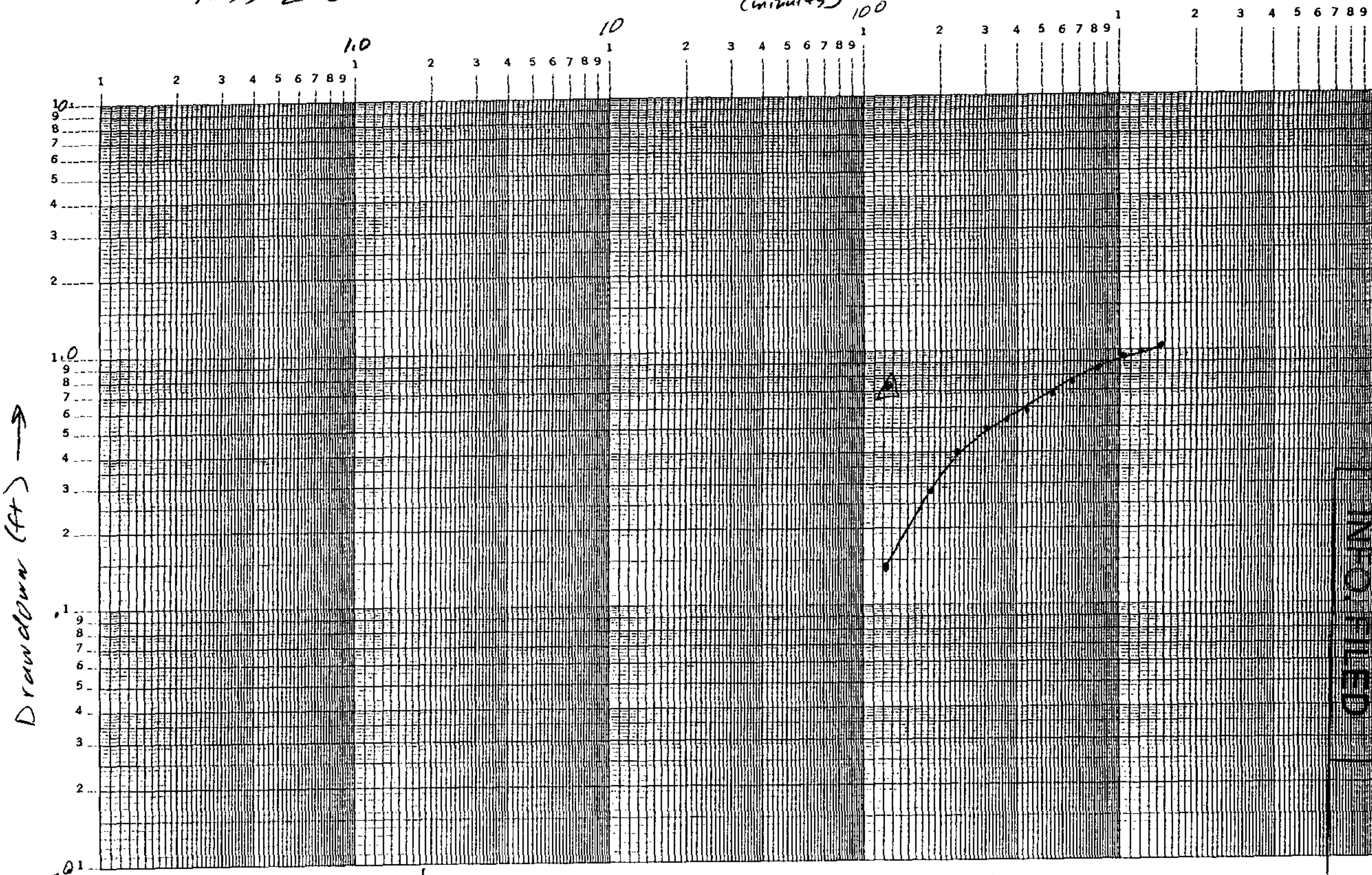
#33-2 OW (#33-1 Pump)



ADDITIONAL INFO. FILED

$\Delta h_o - h = 0.72$

$\Delta t = 127$

$r/B = 0.6$

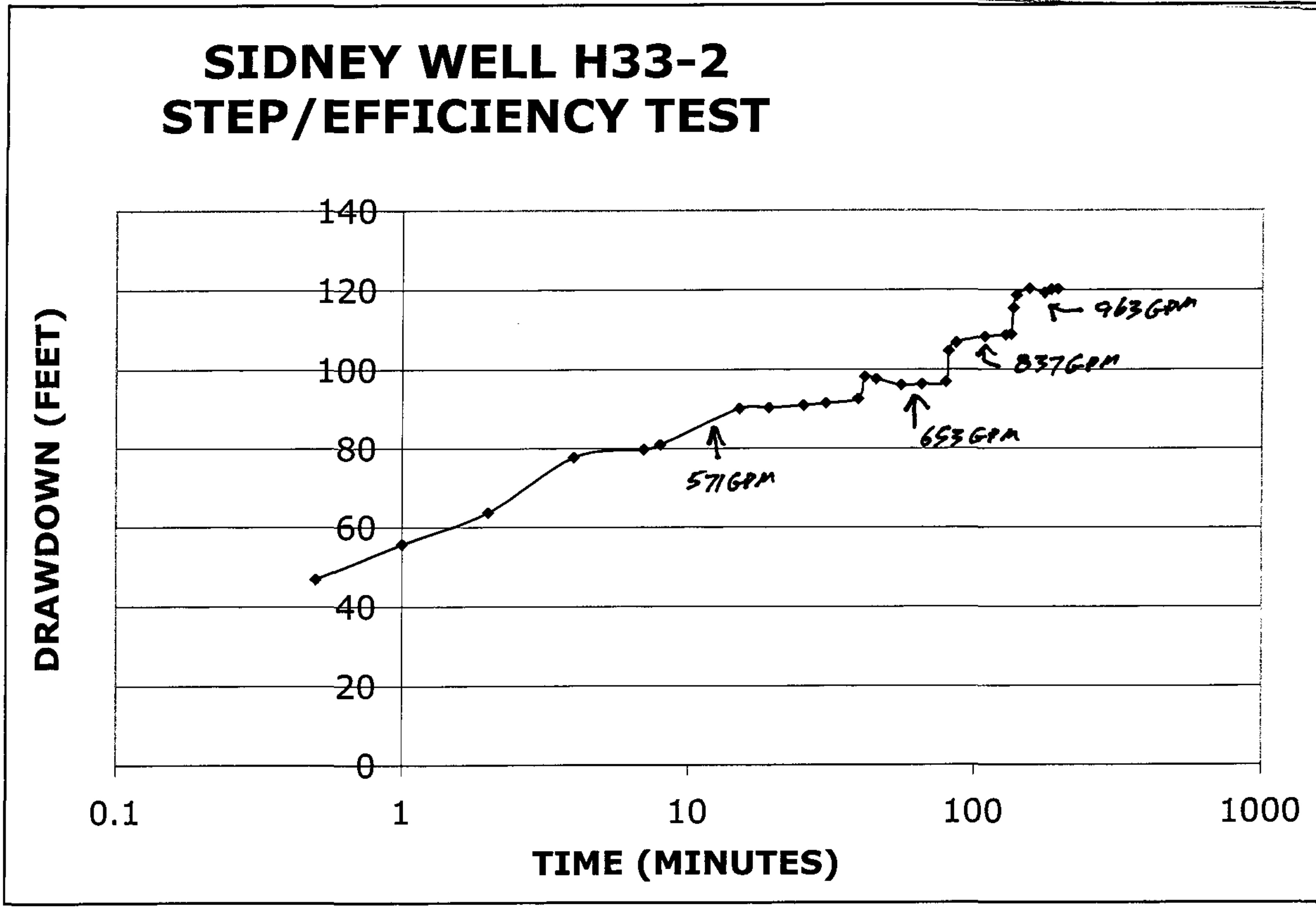
$$T = \frac{15.3Q}{\Delta h_o - h} = \frac{15.3 \times 500}{0.72} = 10{,}625 \text{ ft}^2/\text{day}$$

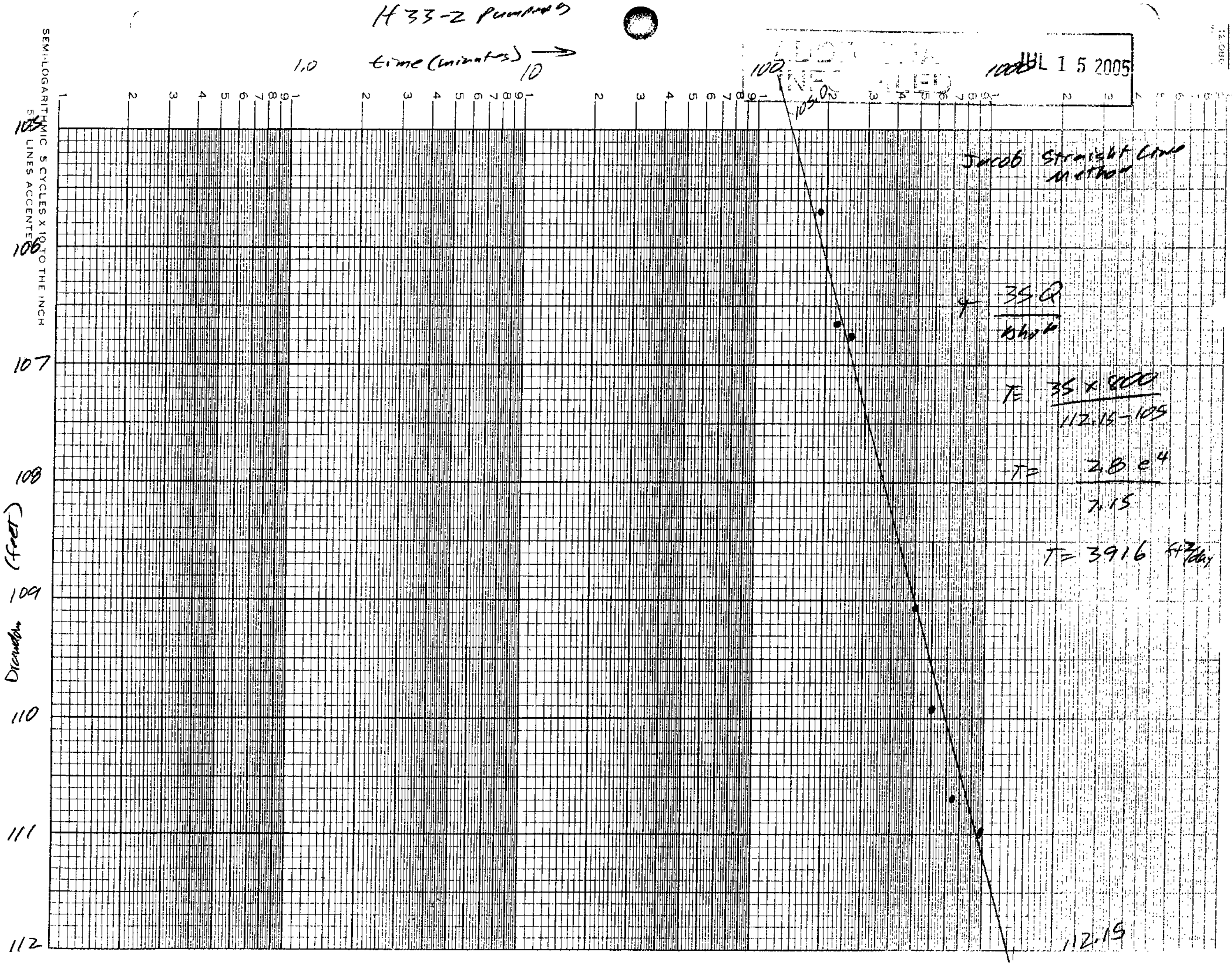
$$S = \frac{T\,\Delta t\,1}{360\,(r)^2} = \frac{10625 \times 127 \times 1}{360\,(3100)^2} = 0.00039$$

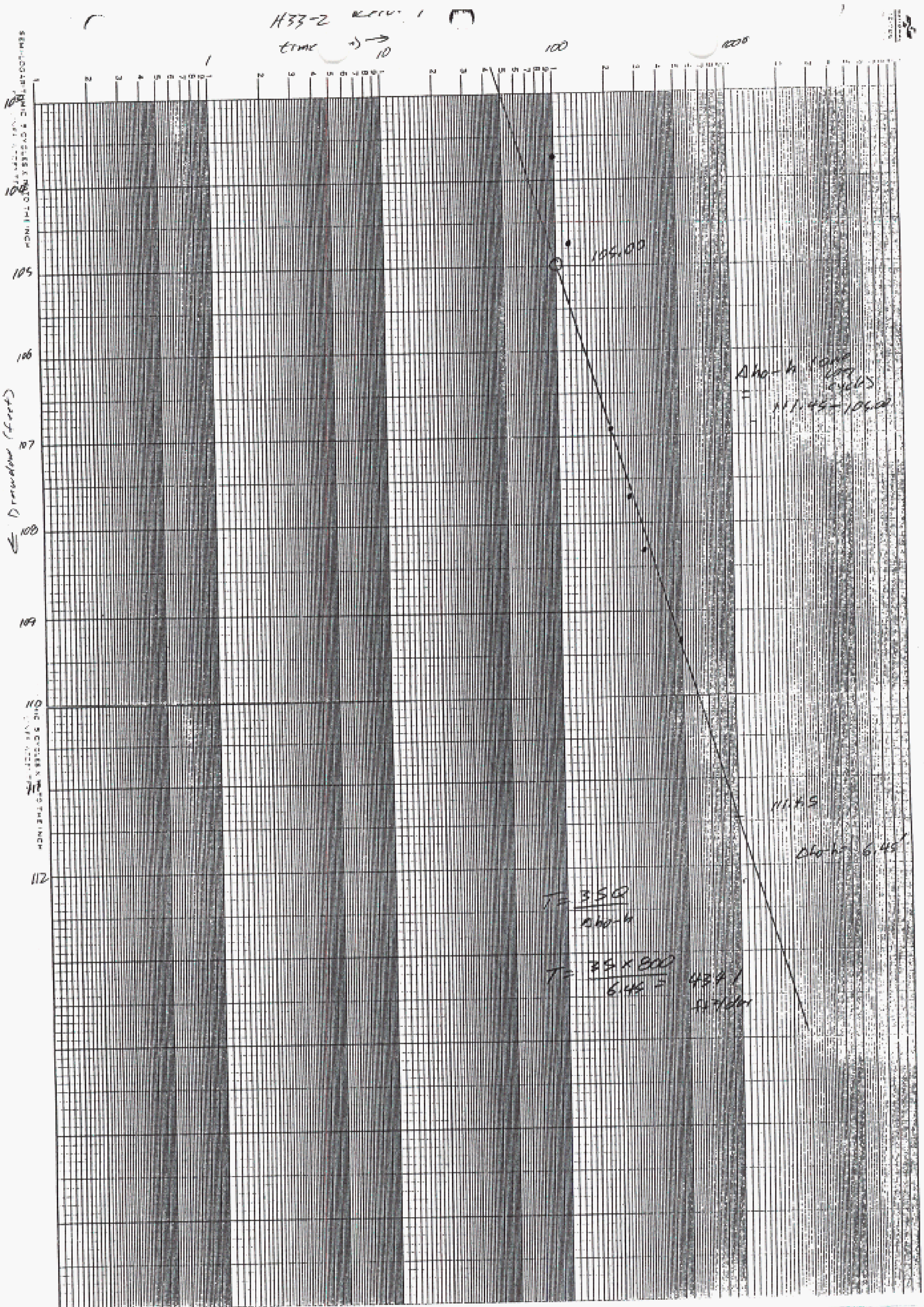
PUMP TEST DATA

SIDNEY WELL H33-2

STEP/EFFICIENCY TEST
H33-2 PUMPING DATA
H33-2 RECOVERY DATA
H33-1 PUMPING DATA
H33-1 RECOVERY DATA
H33-2 (OW) PUMPING DATA
H33-2 (OW) RECOVERY DATA
H33-2 DISTANCE-DRAWDOWN ANALYSIS


SIDNEY WELL H33-2
STEP/EFFICIENCY TEST
DRAWDOWN (FEET)
140
120
100
80
60
40
20
0
0.1
1
10
100
1000
TIME (MINUTES)
571GPM
653GPM
837GPM
963GPM


H33-2 pumping
time (minutes)
1,0
10
100
1000
Drawdown (feet)
105
106
107
108
109
110
111
112
Jacob Straight Line Method
T = 35 x 800 / 112.15 - 105
T = 2.8 e4 / 7.15
T = 3916 ft²/day
112.15
SEMI-LOGARITHMIC 5 CYCLES X 10 TO THE INCH
5 LINES ACCENTED


H33-2
time
1
10
100
1000
Drawdown (feet)
104.00
105
106
107
108
109
110
111
112
111.45

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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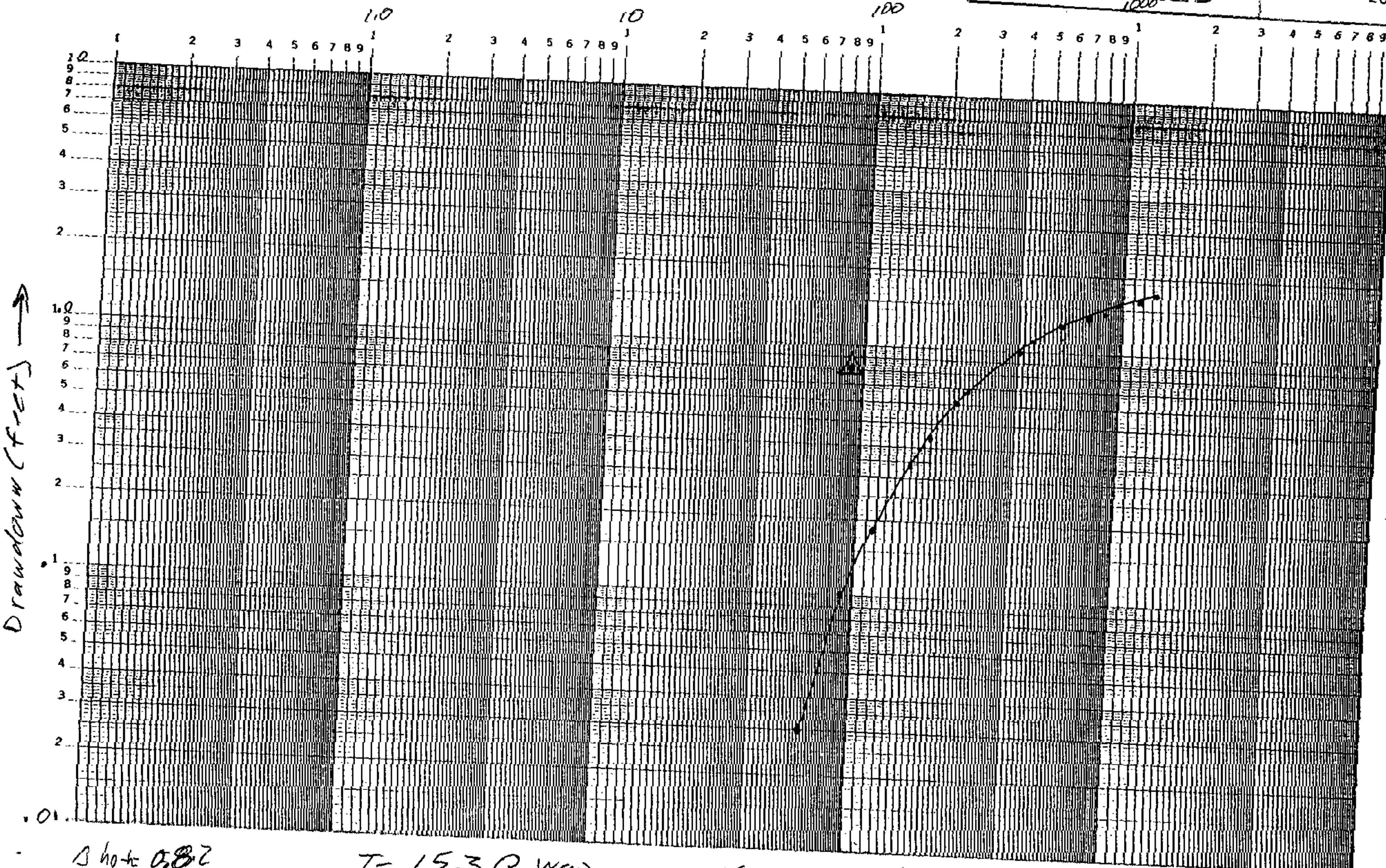
H33-1 (H33-2 Pumping)

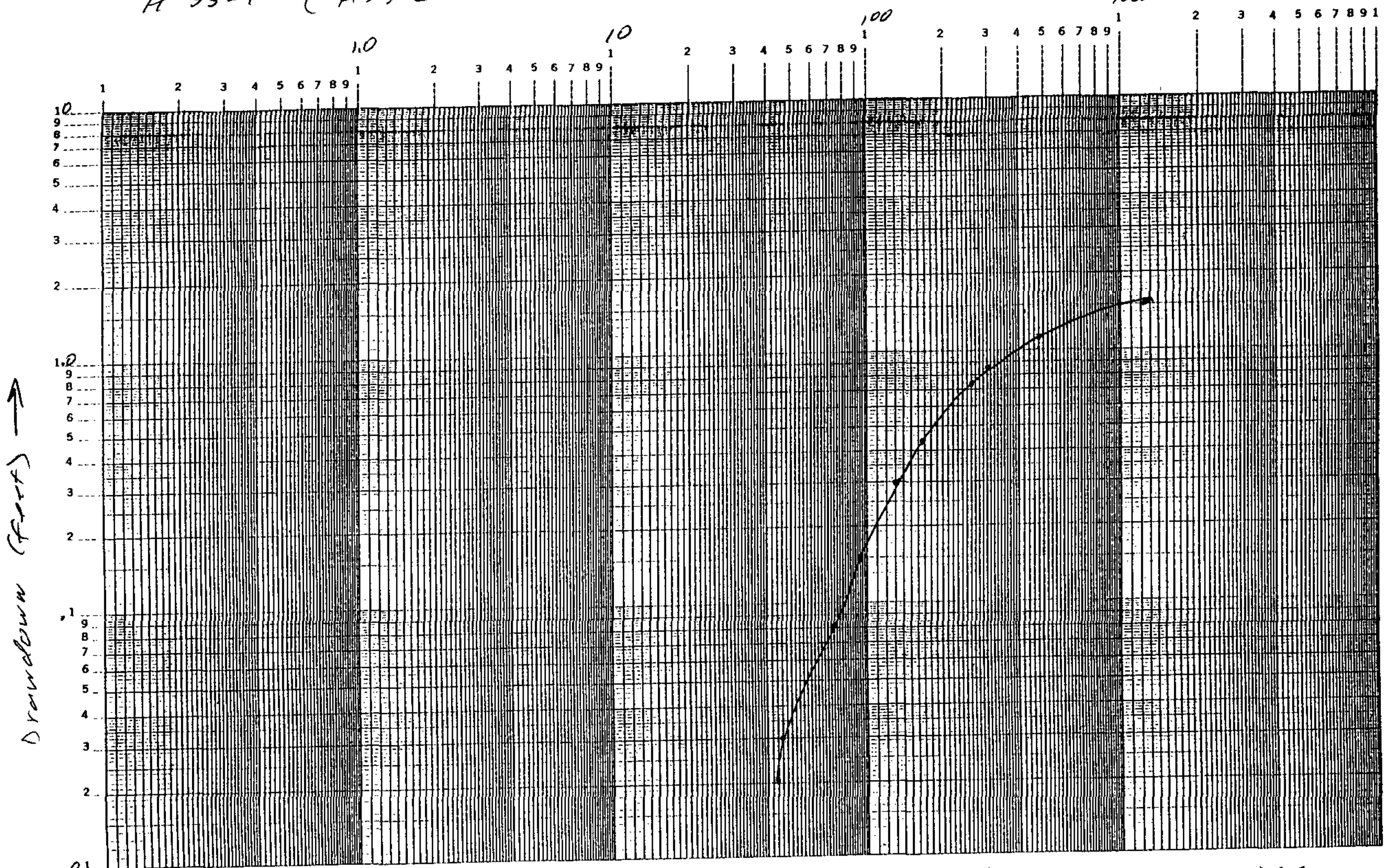


Δh = 0.82
Δt = 90 min

$$T = \frac{15.3\,Q\,W(u)}{\Delta h} = \frac{15.3 \times 800 \times 1}{0.82} = 14,927\ ft^2/day$$

$$S = \frac{14927 \times 90 \times 1}{360\,(3100)^2} = 0.00039$$

H-33-1 (H33-2 Recovery) time (minutes) →



$\Delta h_0 - h = 1.2$

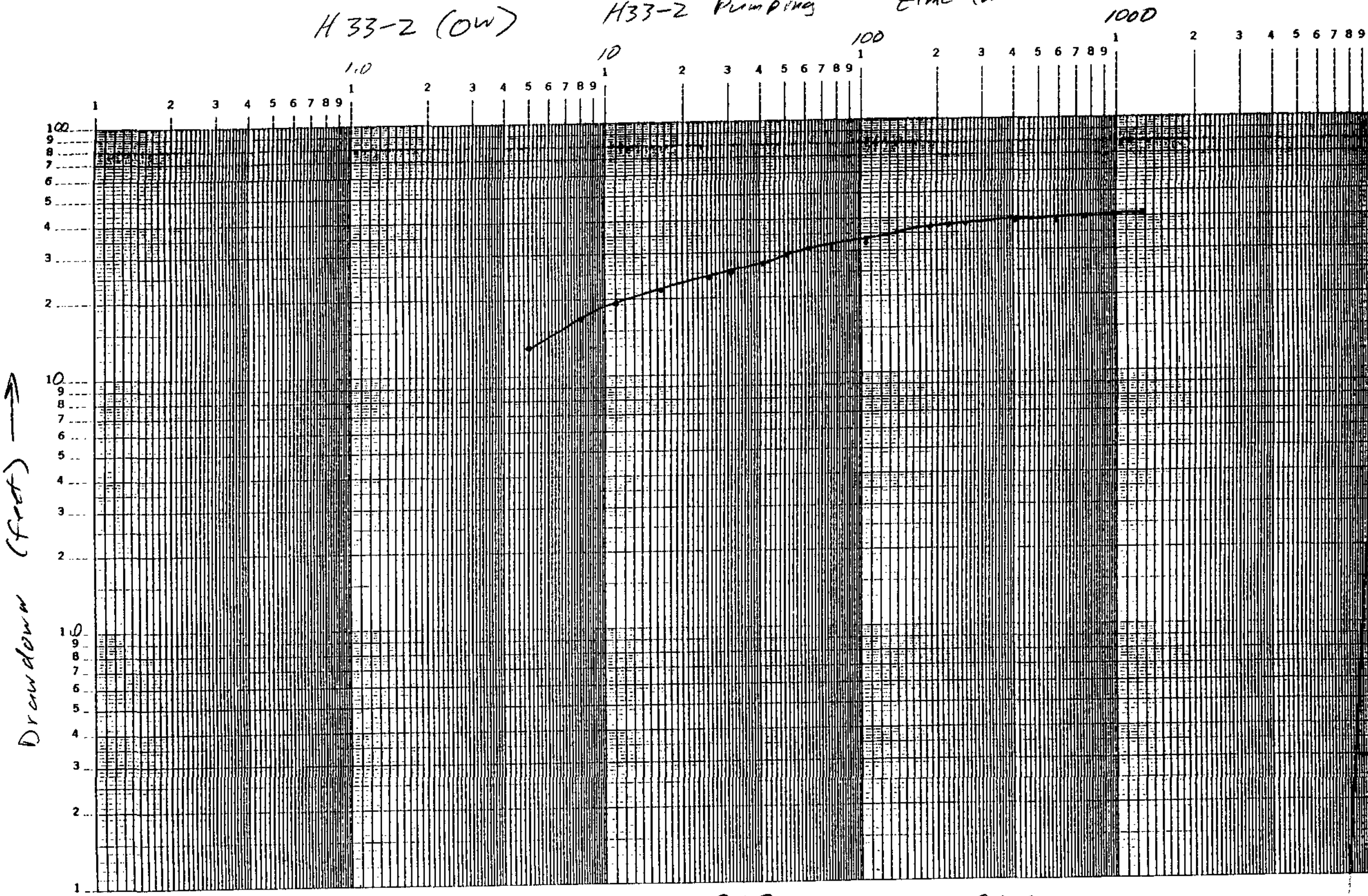
$\Delta t = 115$

r/B = 0.6

$$T = \frac{15.3\,Q\,(W_u)}{\Delta h_0 - h} = \frac{15.3 \times 800 \times 1}{1.2} = 10200 \text{ ft}^2/\text{day}$$

$$S = \frac{10200 \times 115 \times 1}{360\,(3100)^2} = 0.00034$$

K•E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7520



$\Delta h_0 - h = 6.6'$

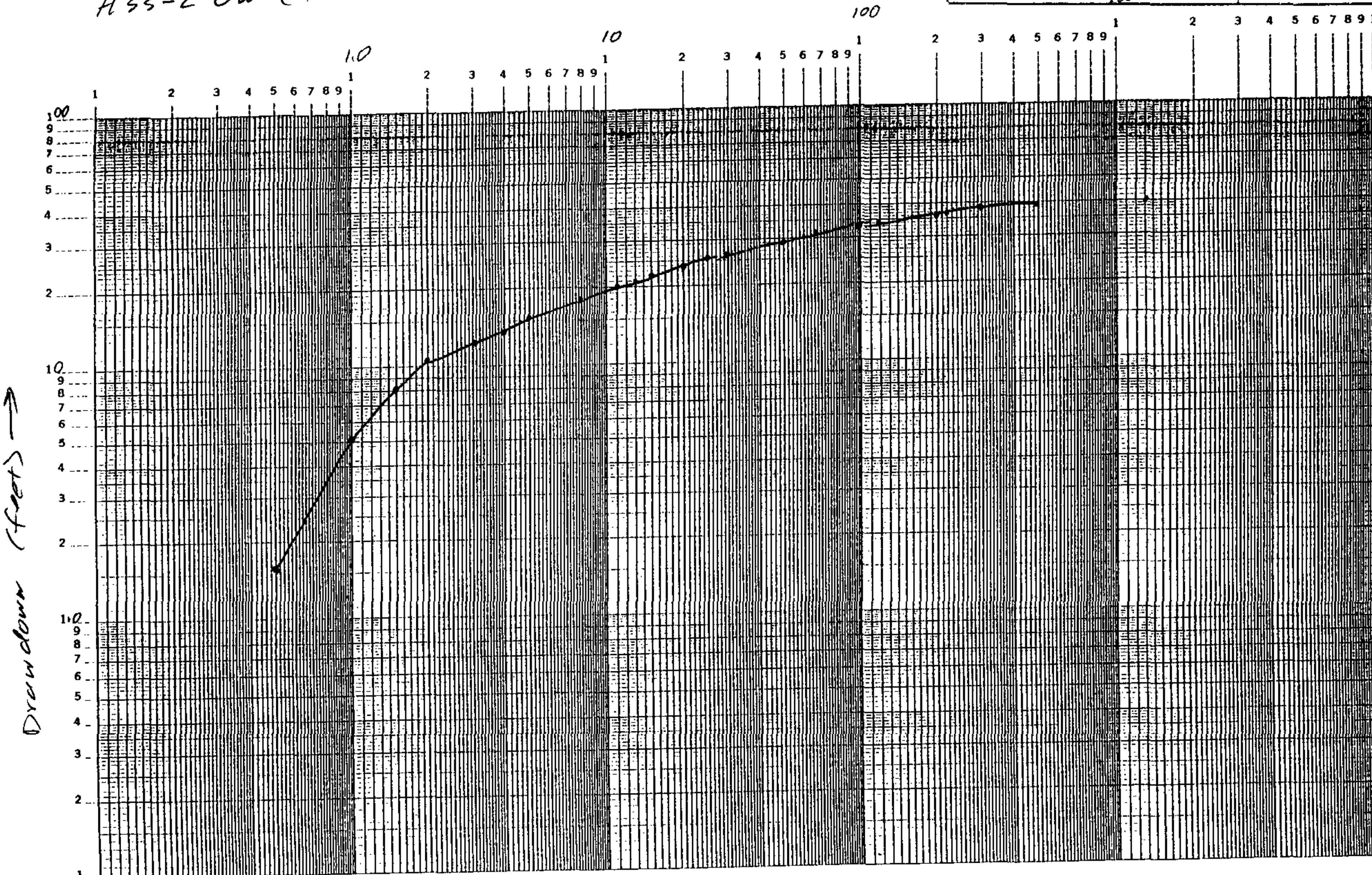
$\Delta t = 0.46$ min

$$T = \frac{15.3Q}{\Delta h_0 - h} = \frac{15.3 \times 800}{6.6} = 1855 \text{ ft}^2/\text{day}$$

$$S = \frac{1855 \times 0.46 \times 1}{360\ (100)^2} = 0.00024$$

K·E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7520

H33-Z OW (H33-Z Recovery)



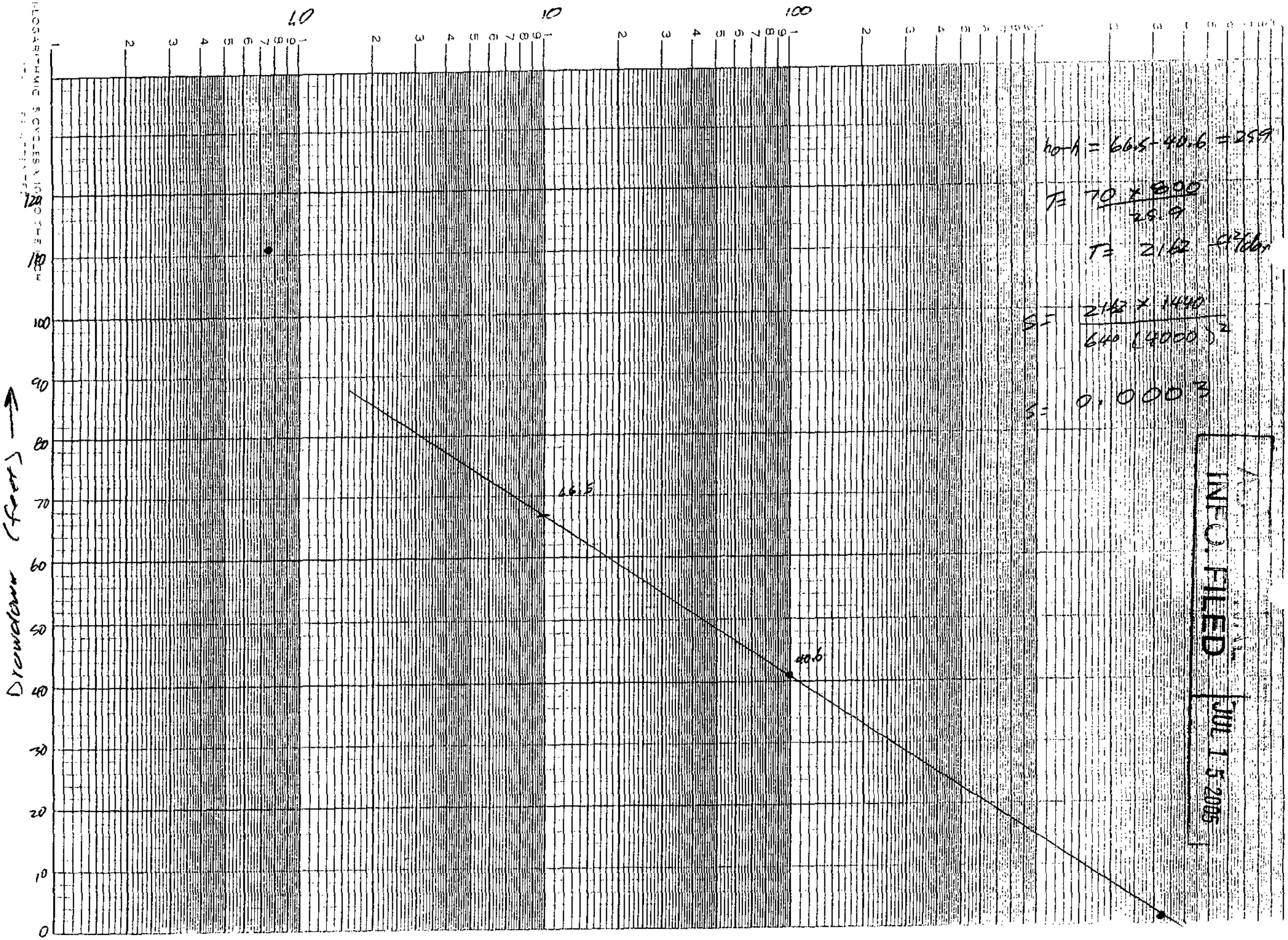
$\Delta ho - h = 8$

$\Delta t = 0.42$

$T = \frac{15.3Q}{\Delta ho - 8} = \frac{15.3 \times 800}{8} = 1530$ ft²/day

$T = \frac{T \, \Delta t \, 1}{360 \, (100)^2}$ $\frac{1530 \times 0.42 \times 1}{360 \, (100)^2} = 0.00018$

H33-2
Distance Drawdown



1. **Questions concerning the confined nature of the Lower Ogallala.**

What is the *geologic* basis *for* the determination that the lower Ogallala unit is confined?

The two lines of evidence that support the determination that the Lower Ogallala Aquifer is confined are based on test hole drilling and the response of the aquifer to pump testing. During the test well drilling phase to evaluate the geology of the three separate properties, it was discovered that there are a number of low permeability clay beds that are present within the middle portion of the Ogallala geologic section that act as aquitards to vertical movement of water. From drill cutting descriptions, the aquitards are typically low-plasticity silty clays. Individual clay beds range in thickness from 15 to 40 feet across the three properties where test holes were drilled.

During the municipal well pump testing period it was noted that the drawdown responses to pumping and recovery of all of the monitoring wells screened in the Lower Ogallala followed the Theis drawdown curve with time. Typically, the Ogallala Aquifer pumping response in western Nebraska is that of a leaky aquifer where the later drawdown responses are flattened due to downward leakage from overlying water-bearing sands. The drawdown responses at the new Sidney Well Field did not show any flattening. The calculated storativity for the wells ranges from 0.0003 to 0.0005. Confined aquifers typically have storativities ranging from 0.001 to 0.00001. Storativity or storage coefficient is a dimensionless number representing the volume of water that a permeable unit will absorb or expel from storage per unit surface area per unit change in head.

What is the aerial extent of the aquitard?

Clay beds separating the upper and lower portions of the water-bearing Ogallala Aquifer are present across the three sections investigated for the City. The aquitard clay beds have not been mapped beyond the well field area. Empirically, the 24-hour pump tests have areas of influence of up to two miles and there was no indication of leakage at the end of the test periods. It is assumed that the aquitards must extend a minimum of two miles away from the pump tested wells.

Please send a typical lithologic log with water levels for the two aquifer units labeled, and two or more cross sections through the proposed well field showing the extent of the aquitard.

Geologic cross sections were prepared to show the relationship between the Upper and Lower Ogallala water-bearing sands and the clay aquitard materials separating them. Figure 1A shows the locations of the cross sections. Figure 2A is a geologic cross section across Section 26 and Figure 3A is a geologic section across Section 33 of T16N-R51W. Figure 4A is a geologic cross section across Section 2 of T15N-R51W.

In addition, is there additional aquifer or pump test data supporting this determination?

The storativity calculation results for all eight wells included in the Transfer Permit application shows the consistency of the small numerical value calculated for this parameter for all of the Lower Ogallala observation wells.

For example, the Jacobson-Helgoth report mentioned different responses in domestic wells to aquifer tests. Was this difference seen in all wells completed in a different unit of the aquifer?

Prior to actual well construction, Layne-Western constructed two temporary water supply wells in Section 26 to supply water for drilling operations. The temporary wells were not used to supply water and were abandoned after the completion of pump testing of the wells in Section 26. One of the water supply wells was constructed halfway between Wells H26-1 and H26-3. The second water supply well was constructed 200 feet northwest of Well H26-4. The construction details of the two wells are not available. It is our understanding that they were only drilled into the upper water-bearing Ogallala sands. During some of the initial pumping tests, water levels were recorded from the water supply wells. It was noted that the water level drawdown responses from these wells were much less than expected from other Lower Ogallala monitoring wells. The attached Section 26 Pump Testing Summary shows the maximum recorded drawdowns at the end of the extended pump tests for the pumped well and the observation wells. For the H26-2 pump test the South Water Supply well exhibited a drawdown of 0.42 feet instead of the predicted 2.0 to 2.1 feet of drawdown. For the H26-3 pump test, the South Water Supply well exhibited a 0.41 feet of drawdown instead of the predicted four to five feet of drawdown. For the H26-5 pump test the shallow water supply wells should have exhibited from 1.5 to 2.0 feet of drawdown. The South Water Supply well declined 0.11 feet during the H25-5 pumping and the North Water Supply well instead of declining actually rose 0.12 feet. All of the observation wells screened in the Lower Ogallala showed a similar and predictable response. There were not any water level measurements made at domestic wells in the vicinity of the Northwest Well Field during pump testing.

2. **Questions concerning hydraulic calculations.**

Were any boundary conditions observed during aquifer testing?

All of the observation wells screened in the Lower Ogallala did not exhibit any boundary effects. The South Water Supply well during the pump testing of H26-1 showed a small boundary effect of 0.23 feet during the last seven hours of the 24-hour pump test. This boundary effect is interpreted as well-to-well interference from preliminary pump testing at Well H26-5.

What program was used to reduce and analyze the drawdown data and calculate aquifer characteristics?

Two generally accepted hydrogeologic calculations were used to analyze the drawdown response data from the pumped wells and the observation wells. The drawdown data from the pumped wells was graphically analyzed using the Jacob Straight-Line Method. The data used for this analysis was the drawdown points observed after the wells had been running for some time and the drawdown decline rate had stabilized. The observation well drawdown response information was analyzed using the nonequilibrium or Theis equations for confined aquifers. The data was graphically plotted and curve-matched using a standard Theis Curve overlay.

Please submit copies of the step, sustained, and recovery curves for the pumped and monitor wells.

Copies of the step, sustained and recovery curves for each of the eight pumped wells and the observation wells used to monitor the pumping influence on the aquifer will be sent as a separate attachment.

3. **Questions concerning pumping impacts.**

Why is the combined radius of influence shown in Figure 3 for wells pumping 510 gpm the same as the radius of influence shown in Figure 4 for 2100 gpm? Was this an error, or is there no measurable difference?

There is very little difference between the 510 gallon per minute rate and the 2,100 gallon per minute rate as far as the outer limit of the combined cones of depression. The transmissivity calculations derived from the pumping well tests indicates that the cones of depression generated by these wells are very thin and the lateral distance between the calculated zero influence limit and one foot of decline is very large.

Under what conditions would the maximum rate of 5300 gpm be withdrawn, and for how long would it be sustained? Is this emergency use only, or could it

occur, say over a very dry summer, despite strict lawn watering controls?

The 5,300 gallon per minute maximum withdrawal rate is based on emergency use only. This withdrawal rate is based on maximum emergency fire flows and would be maintained for so long as fire suppression is required.

Would the resulting cone of depression differ from the cones in Figures 3 and 4?

The Theis Equation was used to estimate the overlapping nature of the cones of depression for the initial pump rates and the total-use scenario. Using the Theis analysis for a 800 gallon per day pump rate for one day, the cone of depression for each pumping well would be increased from one to two feet within 1,000 feet radius of each pumping well. But the combined cones of depression outside of a half mile of the pumped well would not be increased.

Greater than average withdrawal rates would presumably overlap with agriculture irrigation season. Was the combined municipal/irrigation season cone of depression estimated?

As the hydraulic properties of the individual irrigation wells surrounding the well field and irrigation pump rates are not known with certainty, it is difficult to produce an accurate estimate of combined municipal/irrigation impact. The City observation wells constructed prior to the development of the well field indicate that the combined irrigation influence on the Lower Ogallala piezometric surface varies from seven to 10 feet across the well field sections. It is assumed the combined peak summer impact in the two mile radius surrounding the well field would range from eight to 12 feet of lowered piezometric surface depending on proximity to individual pumped wells.

4. **The report references a "Figure 5" showing the well locations, but this either was lost or was not included. Please send another copy.**

ADDITIONAL INFO. FILED | JUL 1 2 2005

Figure 5, the Ogallala Water Table Map is attached to this document.

5. **The report states on page 2, "two shallow zone…wells exhibited only 20 to 25 percent of the decline observed by deeper screened…wells." Did any of the wells that were determined to have been completed in the upper Ogallala show linear drawdown during aquifer testing?**

   The drawdown curves from the Layne-Western water supply wells are included in the pumping well and observation well hydraulic data package. The water level response information form the North and South Water Supply wells was plotted on logarithmic graphs and the water level decline data shows Theis-type responses to nearby pumping wells.

6. **The report states flow in the North Platte River is not expected to be impacted by the proposed well field based on the determination that the lower Ogallala is confined and due to distance to the river. Would this statement still be correct if the aquitard is not extensive, the aquifer does not extend infinitely, and has horizontal and vertical boundary conditions, i.e., the limits of the "paleovalley" mentioned in the report?**

   The statement that "because the aquifer was confined there would not be an impact on surface water supplies", refers to minimal potential for surficial water impact in the vicinity of the well field only. The statements concerning minimal potential impacts on the North Platte River are based on the distance from the Well Field to the river and the COHYST data showing that the well field is far outside of the 15,000-day area of influence. It is our belief that even though the Lower Ogallala Formation is confined at the Well Field, the Ogallala on the benchland between Lodgpole Creek and the North Platte River is a semiconfined/confined aquifer system. The aquitards in the well field area that produce the confined effects are not expected to be continuous between the Well Field and the North Platte River. The Lower Ogallala Aquifer in the Well Field area has been pumped for over 30 years with minimal drawdown effect. The Lower Ogallala sandstones must be extensive and connect at some point to shallower semi-confined water-bearing horizons because of the uniform regional piezometric surface and the pressure rebound after the cessation of summer irrigation pumping. The pump testing at the Well Field did not show any boundary effects and specifically, Well DH-4, the closest well to the eastern porosity pinchout, showed a consistent Theis-type response to drawdown vs time analysis.

7. **The report states part of the justification of the proposed well field is to replace non-rechargeable ground water from the existing, northeast well field. If the proposed wellfield is confined, presumably the recharge rate is also quite low. Was the "lifespan" of the proposed well field aquifer determined?**

The piezometric surface at the Northwest Well Field has fallen approximately six inches per year since the City has been evaluating the potential of the Well Field. This six-inch annual decline is due to the withdrawal of water from existing irrigation wells in the Tableland area. A review of Department of Natural Resources records indicates that there are 202 irrigation wells with capacities in excess of 500 gallons per minute in the 18 townships surrounding the well field. The average drawdown impact per well on the Ogallala Aquifer is 0.0025 feet per year. Assuming that the municipal water wells at the well field will pump an equivalent amount of water as an irrigation well, the three initial operating wells will add 0.0075 feet of annual drawdown to the regional aquifer. This assumes that no additional high capacity wells are allowed to be drilled in the 18 township area.

The water table at the Well Field averages 210 feet below the surface. The top of the well screens average 400 feet from the surface and the pump intakes are set 10 feet above the top of the screen. A non-pumping well currently has 180 feet of water over the pump. A well pumping 1,000 gallons per minute would lower the water level in the well bore approximately 55 feet. Allowing an additional 10 feet of summer decline from nearby irrigation well interference, there is 115 feet of available piezometric head at the Well Field. At an average decline rate of 0.5075 feet per year, it would take 225 years for the piezometric surface to be lowered to the point that the pumping water level would reach the top of the screen. The confined aquifer would still be full of water. The potential effective well life is far in excess of the expected life of the well casing and screens. Replacement wells with screens placed only in the basal Ogallala could extend the useful life of the Well Field an additional 100 to 150 years at current projected withdrawal rates.

8. **Please attach a summary of historical groundwater withdrawals for the City of Sidney, including information on all areas to be served by the new wellfield, including the SID #1 area, and any other uses that have been included in the past and may be included in the future. Present the data in tabular form, with total withdrawal per year for as the last ten years, if information is available. Also include withdrawal per capita and the projections that are the basis used for the municipal transfer request of 1,116,993,750 gallons per year. Please separate and list water used for domestic purposes and water used for industrial and other non-domestic purposes if such information is available. Include a graph showing an averaged one-year daily use for the time period, showing "base" use and maximum summer use in gallons per day.**

In addition, note the difference between ground water withdrawn and ground water consumed as a percent. Please indicate on the historical and projected data whether this is ground water withdrawn or ground water consumed.

The year 2000 was the last year of normal water use in the City of Sidney. With the onset of drought, the City has been engaged in a program of forced conservation with its citizenry and has driven down water usage to an abnormally low level, which quite naturally will rise to normal levels once an adequate source of supply has been acquired. The year 2000 is also the last year of reliable population data, that being the 2000 census. To use any year after 2000 as a base usage year would, in effect, punish the community for having made efforts to conserve water use. Earlier support documentation noted that the municipal usage in Sidney alone in the year 2000 was 756,371,000 gallons. It should be pointed out that the figure included only the municipal water supplied through Sidney's distribution system, and did not take into consideration ground water used at Hillside Golf Course, the Sidney Cemetery and Sioux Meadows housing and adjacent industrial park. Any per capita calculations need to reflect all use. In the year 2000, total usage to serve all areas listed above was 966,740,000 gallons, which, when divided by the census figure of 6,282, gives a per-gallon per-day usage of 421.62 gallons. Based on the pace of economic growth being experienced, as discussed below, the population of Sidney, quite conceivably, will reach 8,200 before 2020. The Sioux Meadows residential population is expected to add 300 (Sidney Sun Telegraph article enclosed). At the same per capita figure, total use would be 1,308,076,050 gallons per year.

Sidney has experienced dramatic growth in employment, housing, and visitors to the community in recent years. Housing units from the year 1996 through 2004 increased 352 units: annual lodging revenue has increased from approximately 1.148 million dollars in 1990 to 5.1 million dollars in 2004; taxable retail sales in Sidney have risen from 46.1 million dollars in 1990 to 128 million dollars in 2004; jobs have increased from 3,426 in 1980 to 6,409 in 2004 with most of that increase occurring since 1990. It is estimated, based on 2002 vehicle counts from I-80 and other highways which pass through Sidney, and particularly the Exit 59 area (Cabela's I-80 location) that 6,199,525 vehicles passed through Sidney carrying more than 15 million travelers. It is estimated, based on sales, traffic counts and customer counts at businesses, that more than three million business transactions occurred in Sidney during 2004. As motels, restaurants and retail business continue to be added, particularly at the I-80 Exit 59 Cabela's location, more travelers and shopping destination and business visitors will be served. It is expected that this growth in employment, housing and the service sector, particularly motels and restaurants, will continue.

On any given day, the population basically doubles as 45% of the labor force filling 6,400 full-time jobs does not reside in the community and commutes to work. This fact alone supports the view that the population of Sidney will grow substantially. In addition to commuters who are expected to relocate to Sidney to be closer to their work site, new employment continues to be added at a steady pace. Both of these factors require expanded housing development. The Cabela's corporate facility recently doubled in size which speaks to the plan for growth on the part of Sidney's and the Panhandle's largest employer. The Cabela's retail store alone draws more than one million visitors annually to its location.

It is also anticipated that the Sioux Meadows Industrial Park, currently housing eighteen businesses and the continued residential development at Sioux Meadows will accelerate development now that an assured supply of water serves that area.

Industrial use of water is limited in Sidney as most business use of water is for sanitation, drinking, food preparation and other domestic purposes. The only large identifiable industrial user is Hillside Golf Course, a municipal facility open to the public which uses approximately 100,00,000 gallons a year (106,769,000 in 2000). The only manufacturers are Krone Digital Communications and Convert-A-Ball, whose use of water in manufacturing is very small. Cabela's Memorial Health Center and Sidney Public Schools, the largest employers in the community, are users in the consumption/health and safety category. Residential and community users are, for the most part, domestic in nature, including in addition to consumption and sanitation, lawn and park irrigation, several car/truck washes, restaurants, services, retail businesses and warehousing.

The U.S. Geological Survey Water Use in Nebraska, 1990, which is included in supporting documentation notes that the consumptive use as a percentage for domestic and commercial totals pumped is 38.2%. The historical and projected data in the first paragraph above and on the historical use chart following is ground water withdrawn.

The three wells formerly serving Sioux Meadows are no longer providing water to the water system which is supplied wholly from the new Northwest Well Field project. In addition, the three wells which in 2004 pumped a total of 215,223,000 gallons from the Northeast Well Field will be held in reserve. At this date, water from the new Northwest well field is simply a replacement of Northeast Well Field and Brule uses. In the future, to the extent that less water is pumped from the Brule due to quantity or quality issues and more is pumped from the new well field, there is simply a replacement of current Brule sources.

It should be noted that the City of Sidney has been the most responsible user in the entire South Platte NRD. Two former agricultural irrigation wells, each pumping approximately 100,000,000 gallons a year, have been taken out of service. Please note that the U.S. Geological Survey reports that the consumptive use of water for irrigation is 65.1% which, when applied to the 200,000,000 gallons per year no longer pumped, translates to consumptive use savings of 130,200,000 gallons of water per year. Note that since the city distribution system serves primarily domestic and commercial uses (38.2% consumption), that the City would have to pump an additional 340,837,697 gallons per year to consumptively use the amount consumptively saved by shutting down these two agricultural irrigation wells. That figure added to the 966,740,000 gallons pumped at all locations in 2000 totals 1,307,577,697.

9. Water quality questions.

Please attach water quality analysis for each of new wells, specifically nitrite-nitrate, arsenic, uranium, and manganese.

ADDITIONAL INFO. FILED | JUL 12 2005

Water Quality Summary

Well	Arsenic (ppb)	Nitrate-Nitrite (mg/l)	Manganese (ppb)	Uranium (ppb)
MCL	**10**	**10.0**	**50***	**30**
DL-4	5.68	2.0	ND**	8.10
H26-1	6.10	1.5	ND	9.08
H26-2	6.16	1.7	ND	8.65
H26-3	6.35	1.5	ND	9.33
H26-4	5.47	1.3	1.30	9.18
H26-5	5.92	1.4	1.14	9.21
H33-1	5.53	1.2	ND	9.94
H33-2	5.87	1.3	ND	9.20

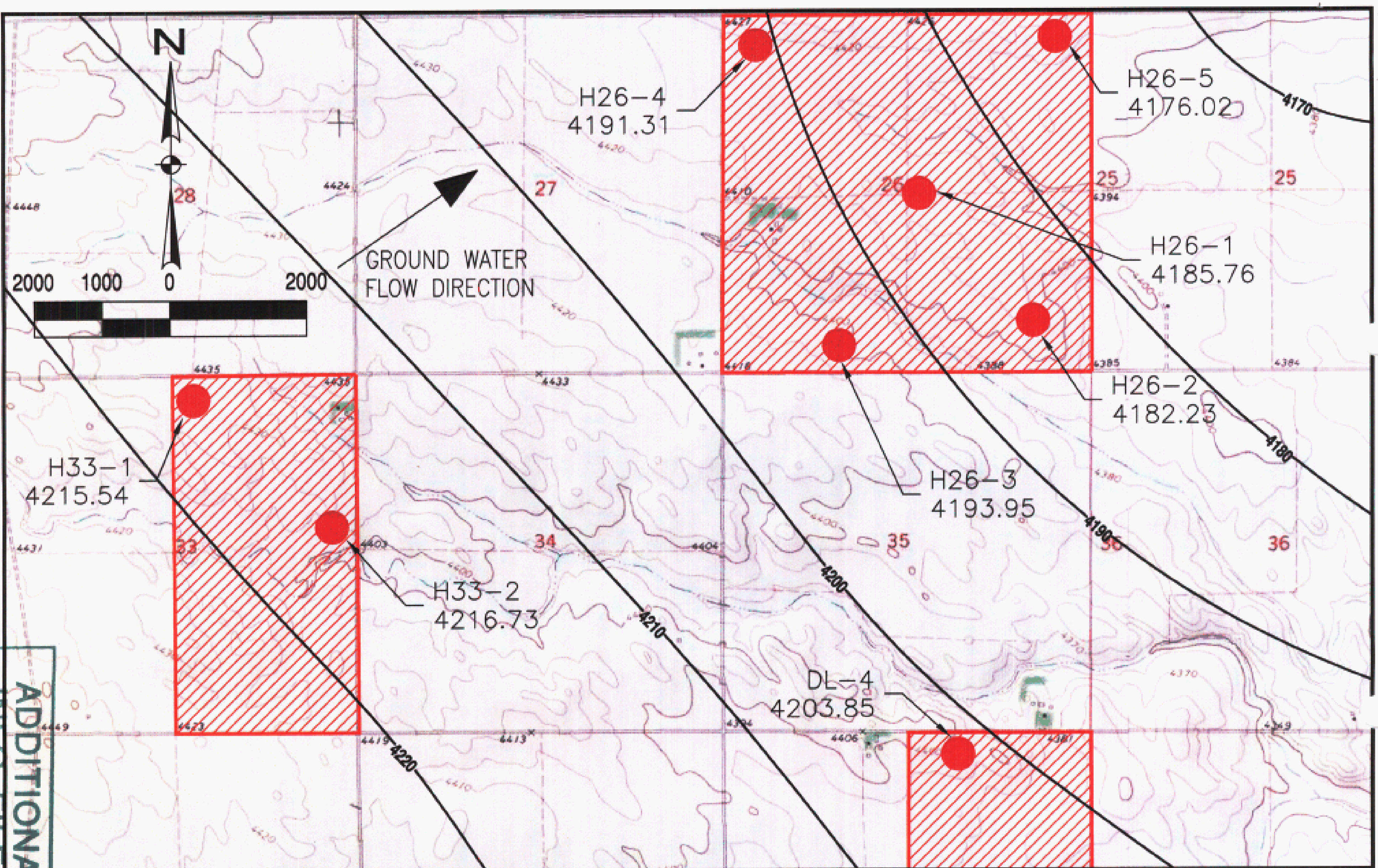
* = Secondary Contaminant Standard
** ND = Not Detectable

Will irrigation continue on lands where the proposed wells are located?

No

Do domestic wells in this area have higher nitrate-nitrite levels that irrigation wells?

Limited water quality data from the South Platte NRD nitrate monitoring program indicates that the nitrate-nitrite levels in both the domestic and irrigations Ogallala wells in the area between Sidney and Dalton have not been influenced by agricultural activities.



Jacobson Helgoth CONSULTANTS

FILE NO.: 072304 WELL FIELD.DWG

DATE: 07/26/04
SCALE: 1" = 2000'
PROJ. NO.: 106-46
DRAWN: ADN
CHECKED: NCH
FIG 7

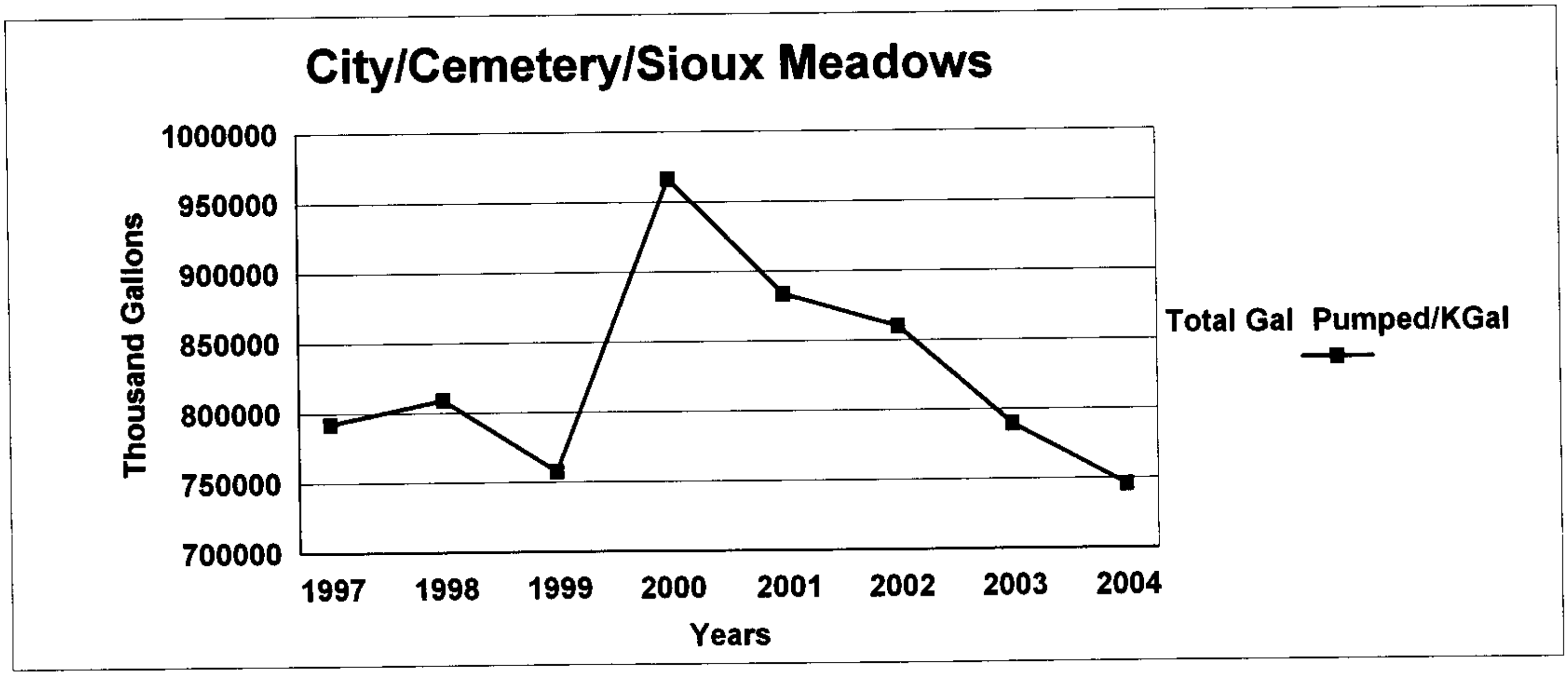
PIEZOMETRIC SURFACE ELEVATION
(ELEVATION ABOVE MSL)
NORTHWEST WELL FIELD
CITY OF SIDNEY, NEBRASKA

TOTAL GROUND WATER WITHDRAWALS
CITY OF SIDNEY/SIOUX MEADOWS

YEAR	GALLONS
1995	730,033,000
1996	764,284,000
1997	792,432,000
1998	809,279,000
1999	757,514,000
2000	966,740,000
2001	883,804,000
2002	860,304,000
2003	789,790,000
2004	746,089,000

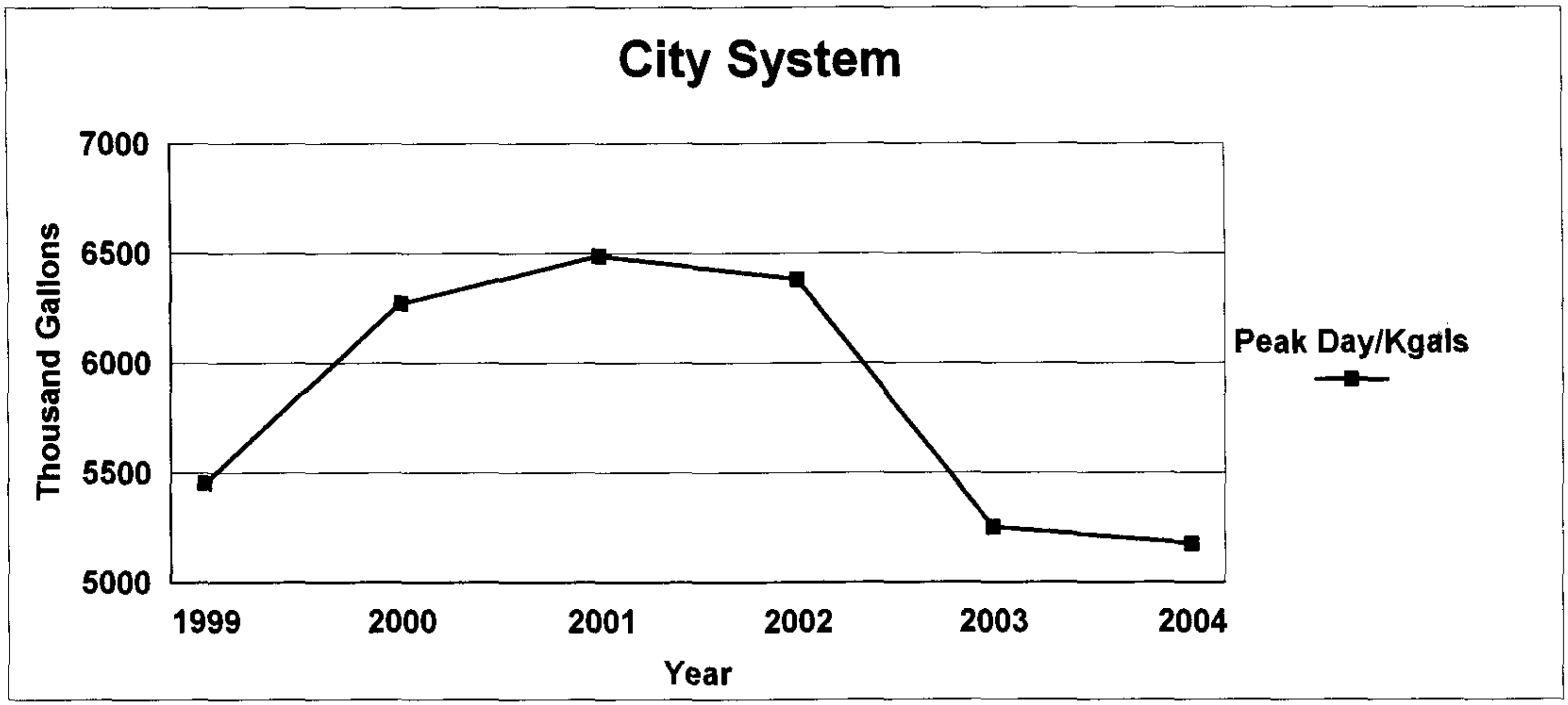
Historical City Use
Estimated Cemetery and Sioux Meadows
Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

Year	Total Gal Pumped/KGal
1997	792432
1998	809279
1999	757514
2000	966740
2001	883804
2002	860304
2003	789790
2004	746089



Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

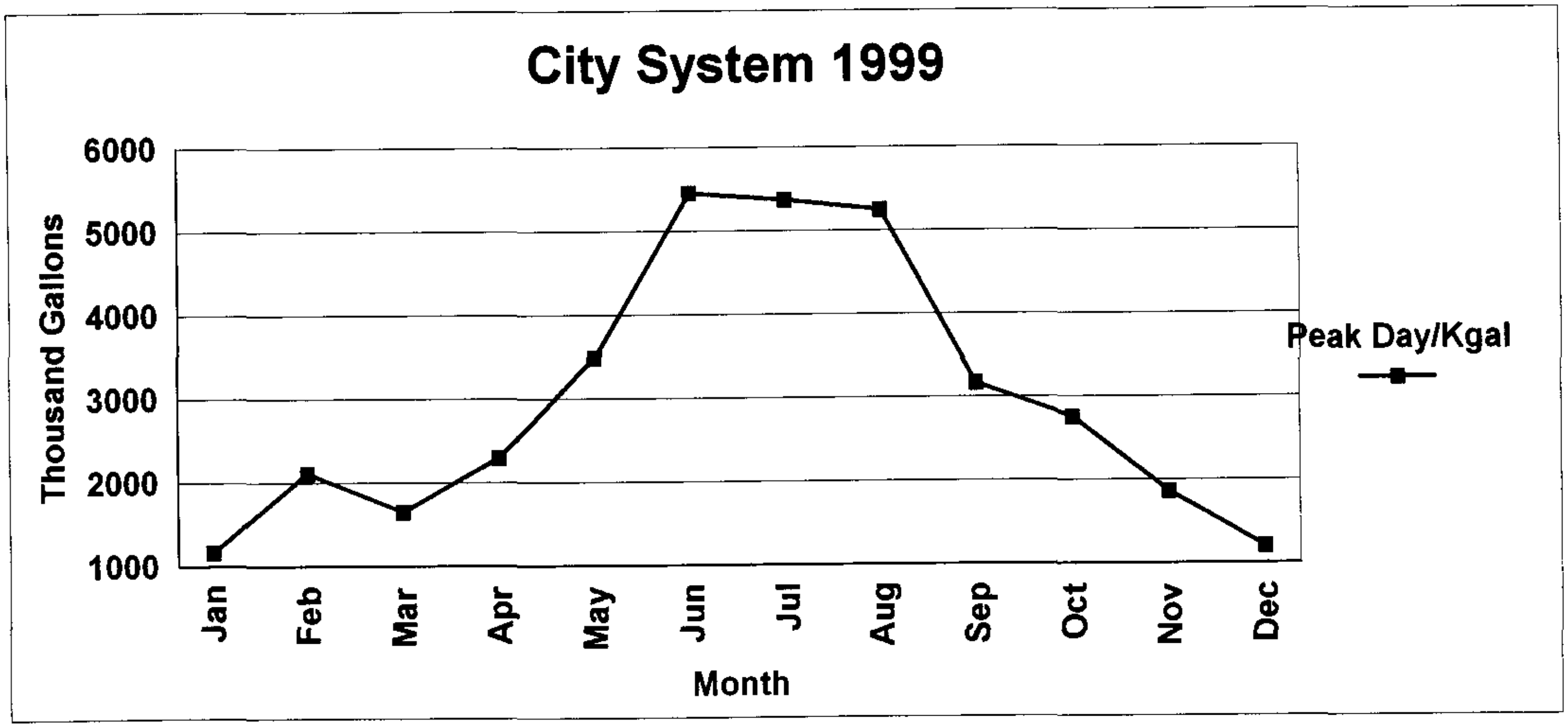
Year	Peak Day/Kgals
1999	5458
2000	6275
2001	6491
2002	6383
2003	5253
2004	5179



1999

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

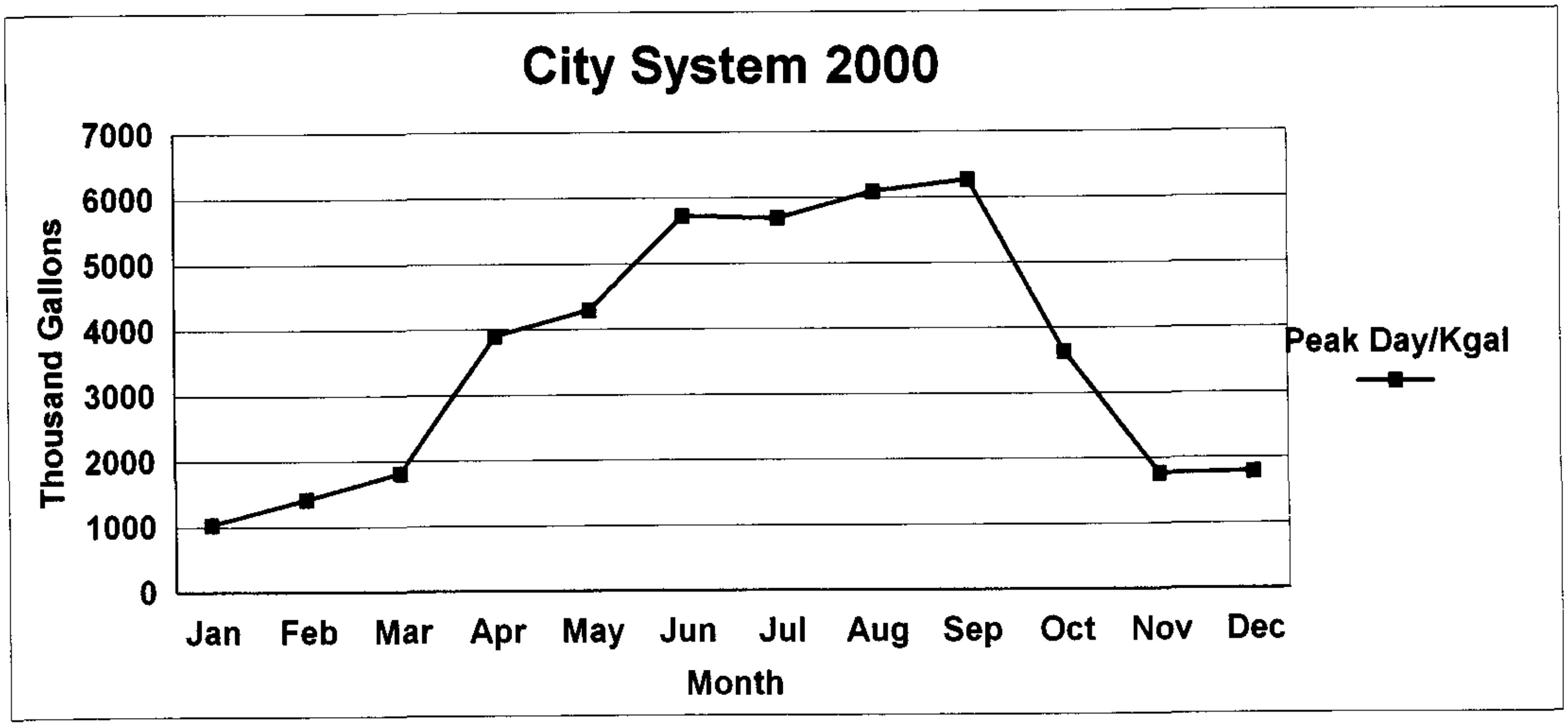
Month	Peak Day/Kgal
Jan	1167
Feb	2120
Mar	1653
Apr	2303
May	3489
Jun	5458
Jul	5373
Aug	5250
Sep	3174
Oct	2760
Nov	1866
Dec	1205



2000

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

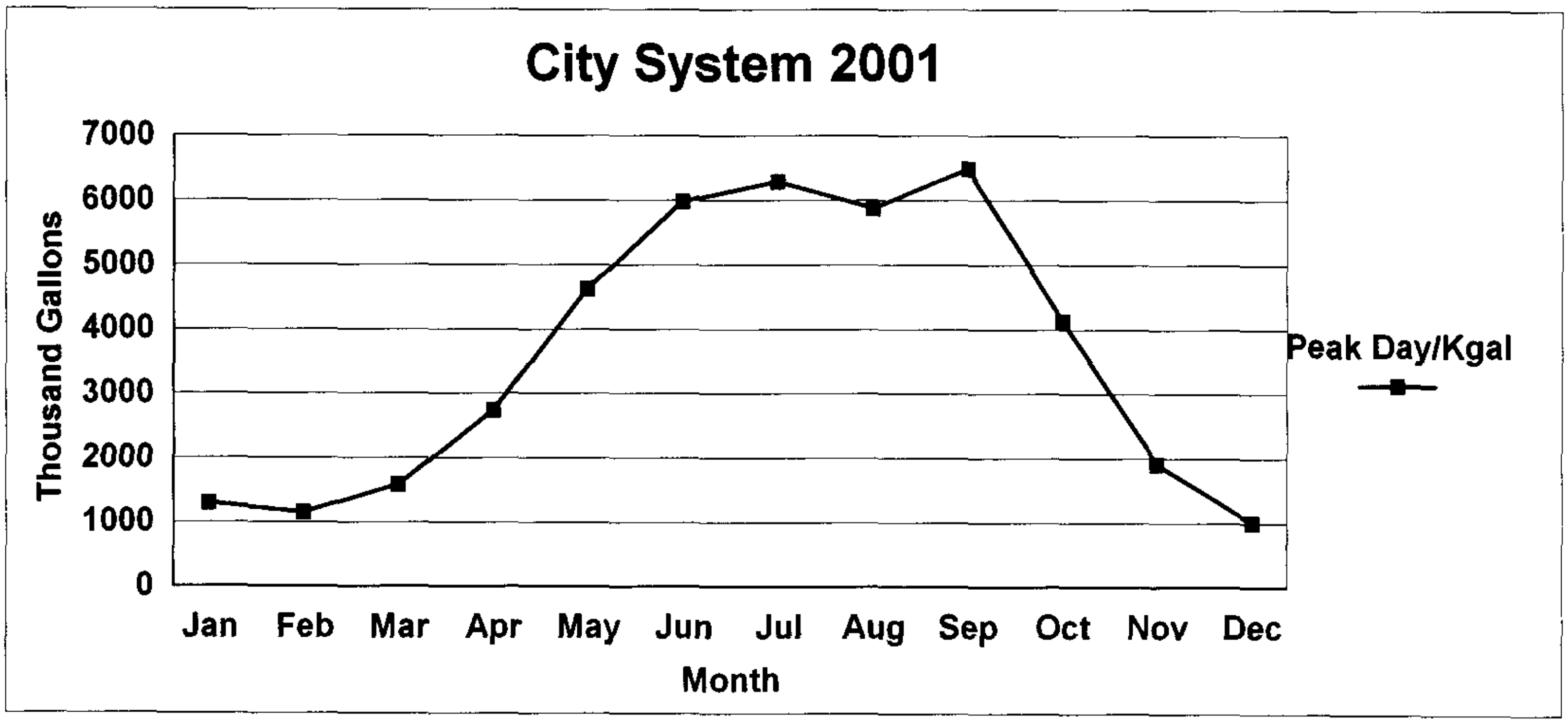
Month	Peak Day/Kgal
Jan	1039
Feb	1427
Mar	1818
Apr	3906
May	4306
Jun	5726
Jul	5695
Aug	6102
Sep	6275
Oct	3636
Nov	1774
Dec	1792



2001

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

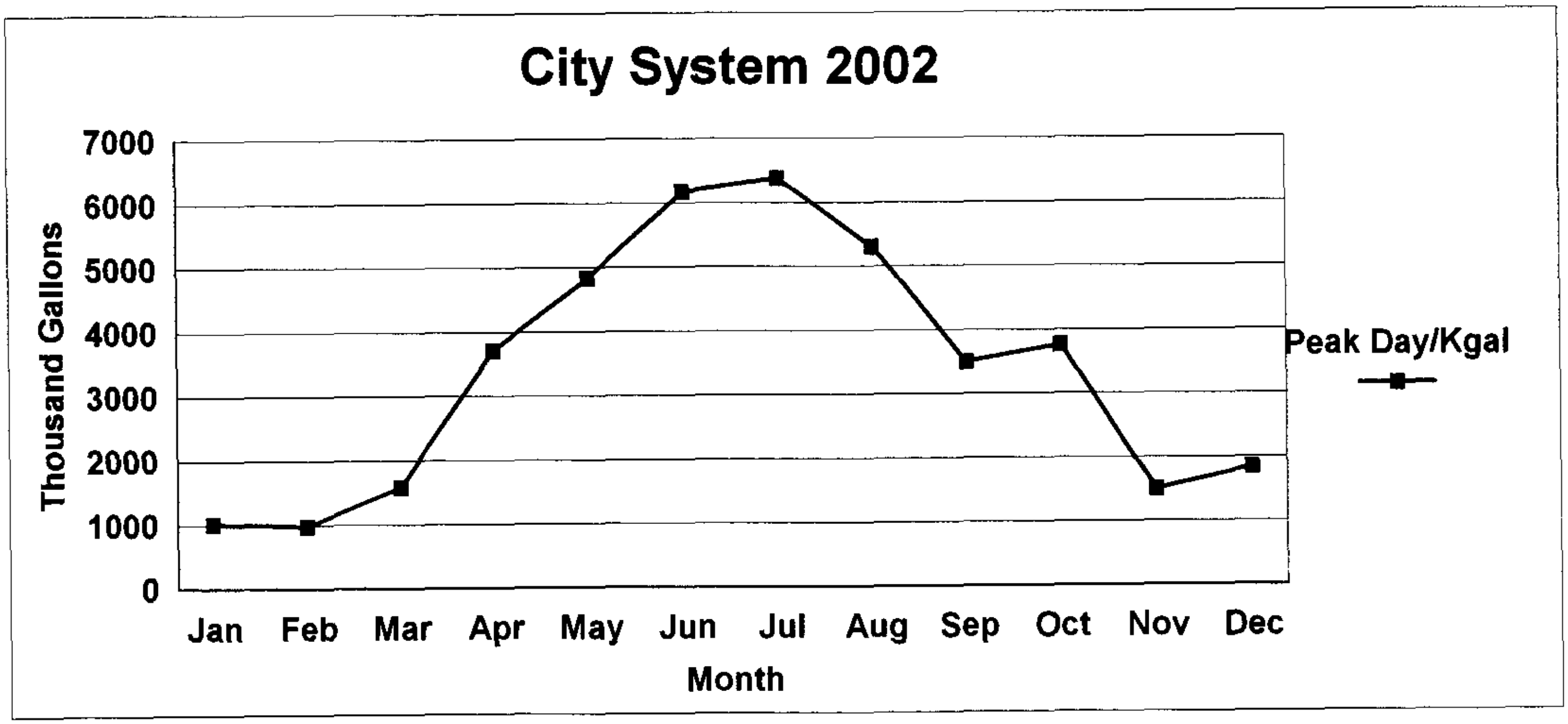
Month	Peak Day/Kgal
Jan	1298
Feb	1156
Mar	1588
Apr	2750
May	4631
Jun	5990
Jul	6295
Aug	5881
Sep	6491
Oct	4138
Nov	1922
Dec	1006



2002

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

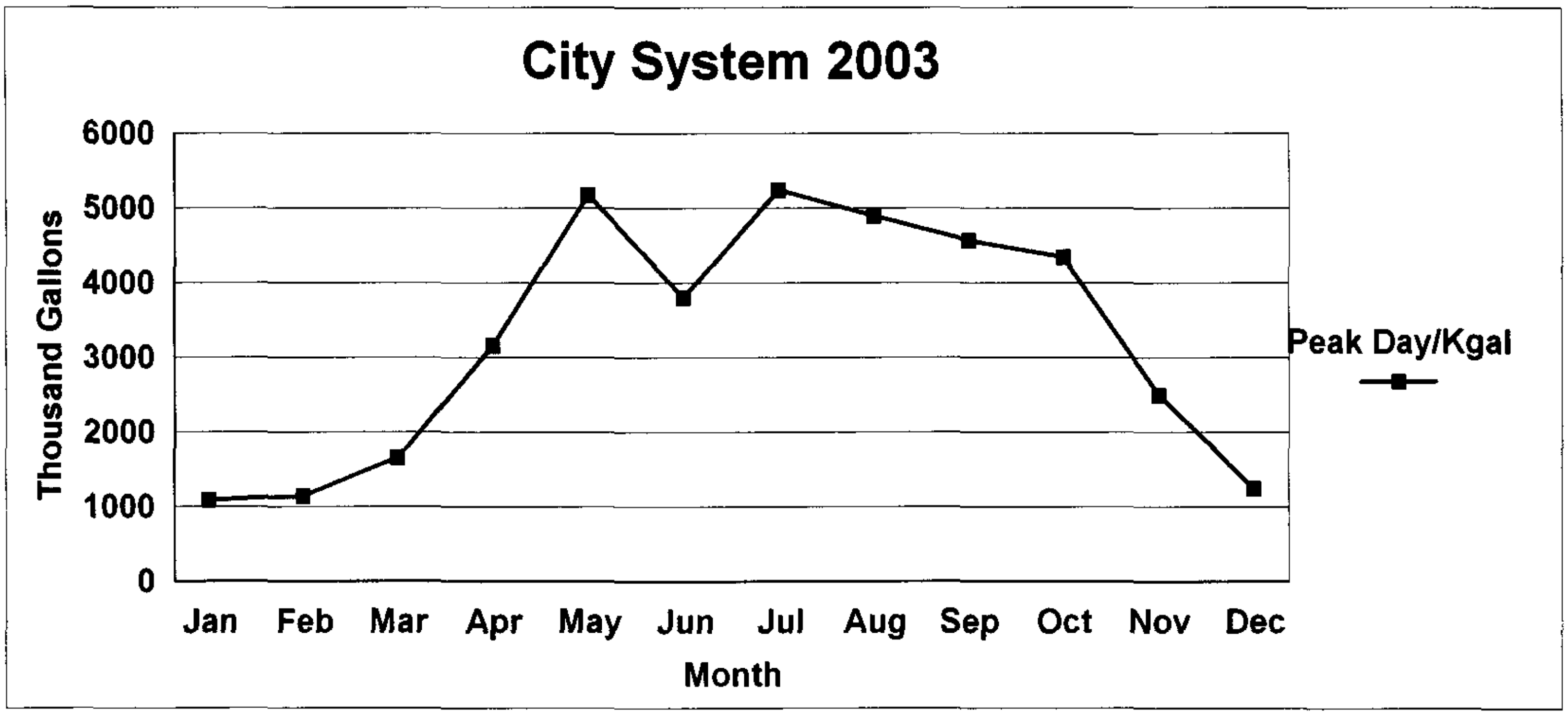
Month	Peak Day/Kgal
Jan	1025
Feb	978
Mar	1586
Apr	3711
May	4834
Jun	6179
Jul	6383
Aug	5310
Sep	3507
Oct	3773
Nov	1507
Dec	1848



2003

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

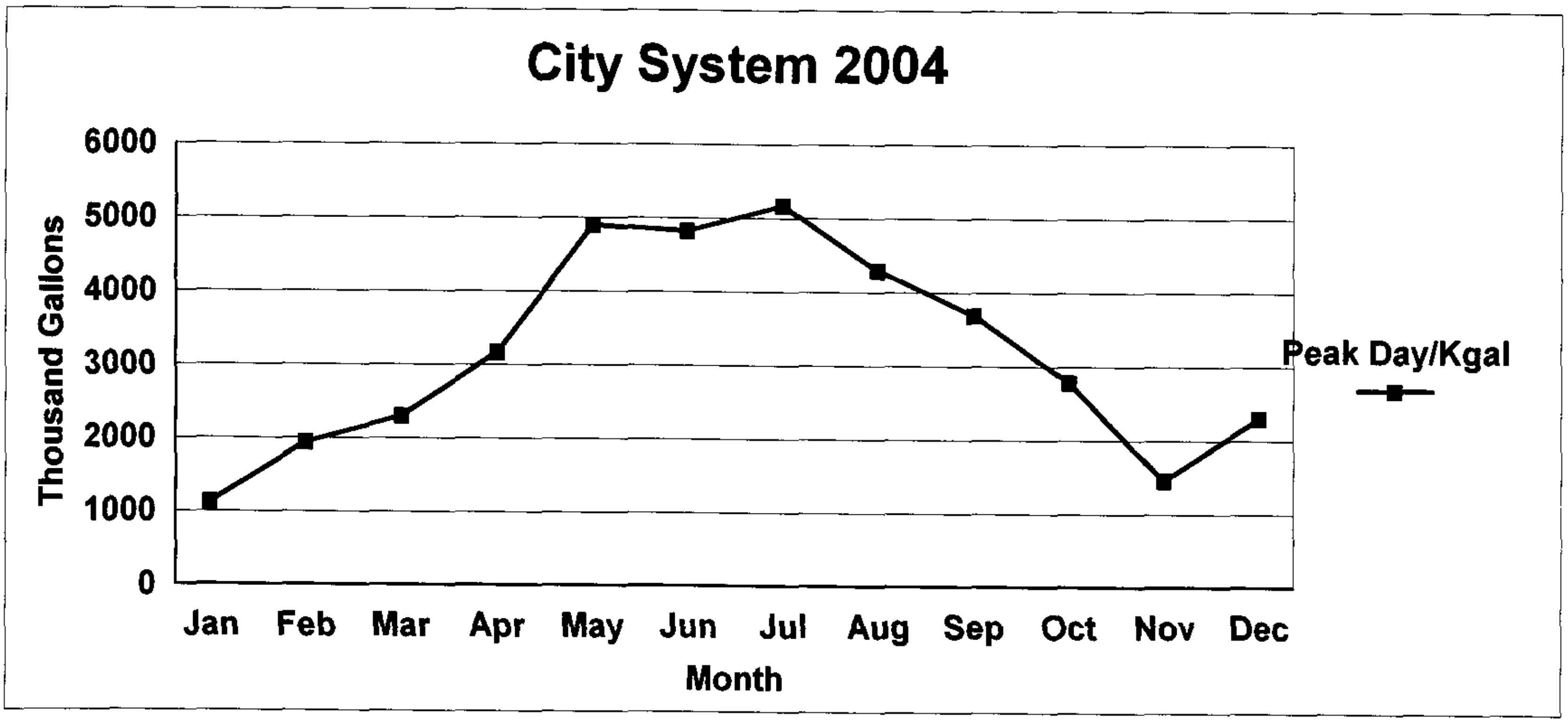
Month	Peak Day/Kgal
Jan	1099
Feb	1147
Mar	1668
Apr	3166
May	5186
Jun	3811
Jul	5253
Aug	4902
Sep	4570
Oct	4349
Nov	2506
Dec	1250



2004

Millions of Gallons Expressed in Thousands
(Add 3 Zeros to each Figure)

Month	Peak Day/Kgal
Jan	1131
Feb	1942
Mar	2306
Apr	3171
May	4905
Jun	4831
Jul	5179
Aug	4297
Sep	3696
Oct	2784
Nov	1458
Dec	2303



Water Use in Nebraska, 1990

	Domestic & Commercial	*Irrigation & Livestock*	*Industrial & Mining*	*Thermoelectric Power*
Water Use	**351**	6990	230	2450
Consumptive Use	134	4550	35	25
Consumptive Use as % of Water Use	38.2%	65.1%	15.2%	1.0%
Consumptive Use as % of Nebraska Consumptive Use	2.8%	95.9%	.7%	.5%

Source: Estimates of Water Use in the Western United States in 1990 and Water-Use Trends 1960-90, U.S. Geological Survey.

Town houses just first phase of Sioux Meadows development

BY GORDON R. TUSTIN
SUN-TELEGRAPH

A major player in the Sidney development scene is about to make another impact in Cheyenne County's economic development.

Bob Ehrlich of Windsor, Colo., a major real estate developers along the Colorado Front Range, and already a major property owner of development areas around Sidney, will begin work soon on the conversion of the old Ordville apartments into more than 200 townhouses.

It's all part of the new Sioux Meadows, LLC development. Ehrlich purchased the former Sioux Army Depot's main campus area last year.

"He is a major player," said Gary Person, director of the Sidney/Cheyenne County Economic Development. "He has owned property here for five years. He is a class act. His reputation is impeccable."

Ehrlich said the conversion of the old barracks into townhouses is the first step in a multi-million dollar development of the old depot.

"We want to work through all of the old barracks, remodel all of those, and sell them to people in the community and the outlying area," Ehrlich said in a telephone interview. Each of the 68 barracks will be converted into three townhouses, resulting in a total of 204 living units. "They are going to look brand new," Ehrlich said.

He said he hopes to have that phase of his development plans completed in about three years, "Depending on sales, it could go a little slower than that," Ehrlich said. "I guess that's our optimistic viewpoint on it."

Cox Brothers Development will be the general contractor.

"In addition, what was known as the old officers quarters – there are five houses – we have subdivided those and we will sell those," Ehrlich said. The commercial site on what was the former campus of Western Nebraska Community College vocational department before the school moved to its new location on the east side of Sidney, which has several warehouses, will also be subdivided and sold.

"Presently we have approximately 160 new jobs coming out to that area," he said.

He said there are no particular plans at present on what to do with the former administration building, fire hall, cafeteria school and other large buildings that served both depot personnel and WNCC students.

"Nothing particular on those," Ehrlich said. "Those are kind of on the back burner. What we are concentrating on is getting the barracks

■ Meadows/page 3

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■ Meadows (from page 1)

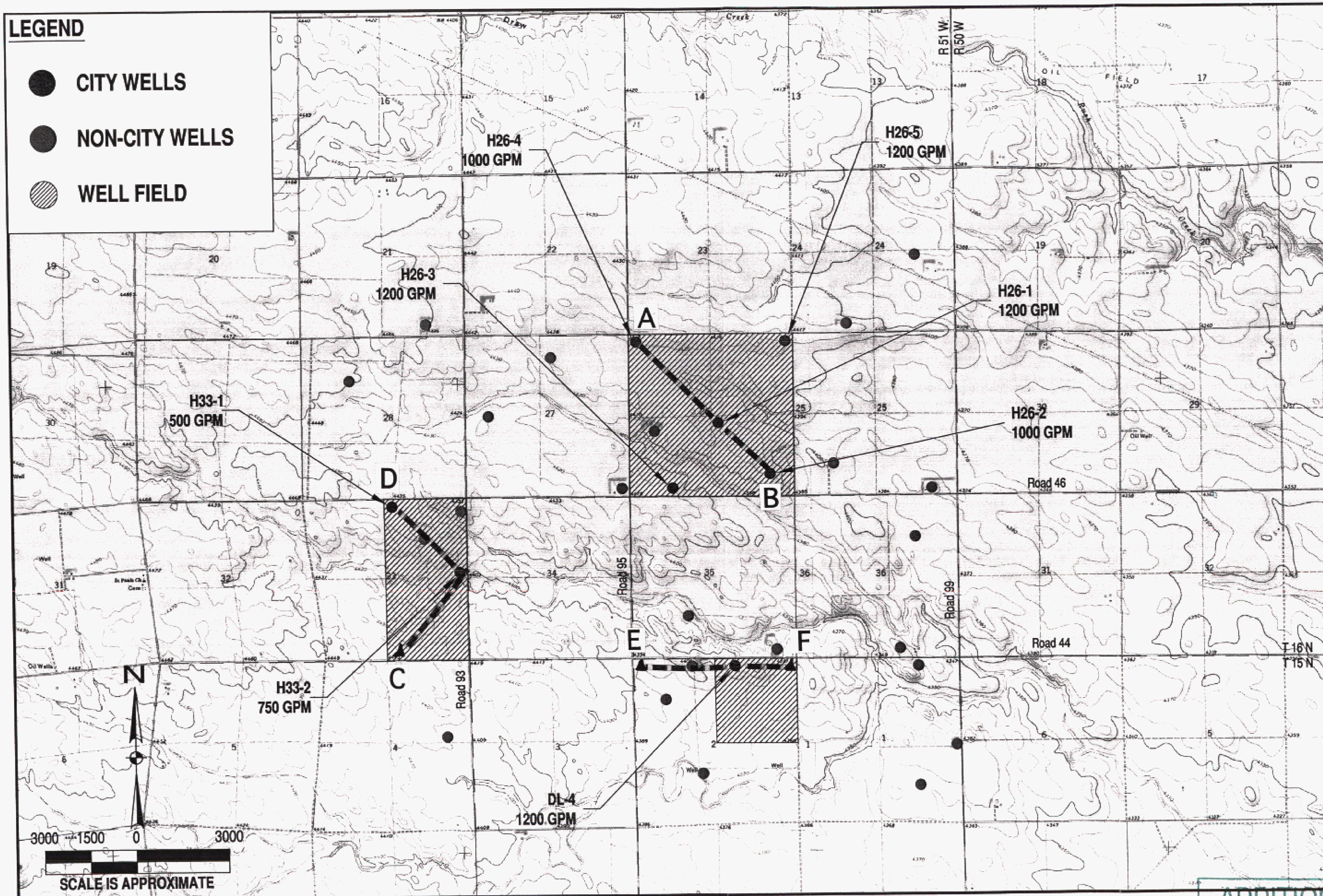
converted to the townhouses and getting the five officer's quarters sold and concentrating on the commercial side of the thing."

There is also a convenience store planned to serve the area. Ehrlich said he met Tuesday with people concerning the convenience store. "They want to have a few more numbers built up subject to having enough people out there to keep them afloat," He added.

"We also have a person we are going to go into contract with to have a restaurant operation out there," Ehrlich said.

"We're going to convert those old barracks into a nice, livable community," he said.

Person said Ehrlich and Donny Adams of Adams and Son Trucking gives that area two first class developers. "This is something that some communities spend millions of dollars trying to invent. Now we have the right developers in place. We have tremendous potential just from that aspect of the development. We couldn't be more thrilled," Person said.



GEOLOGIC CROSS-SECTION
INDEX MAP

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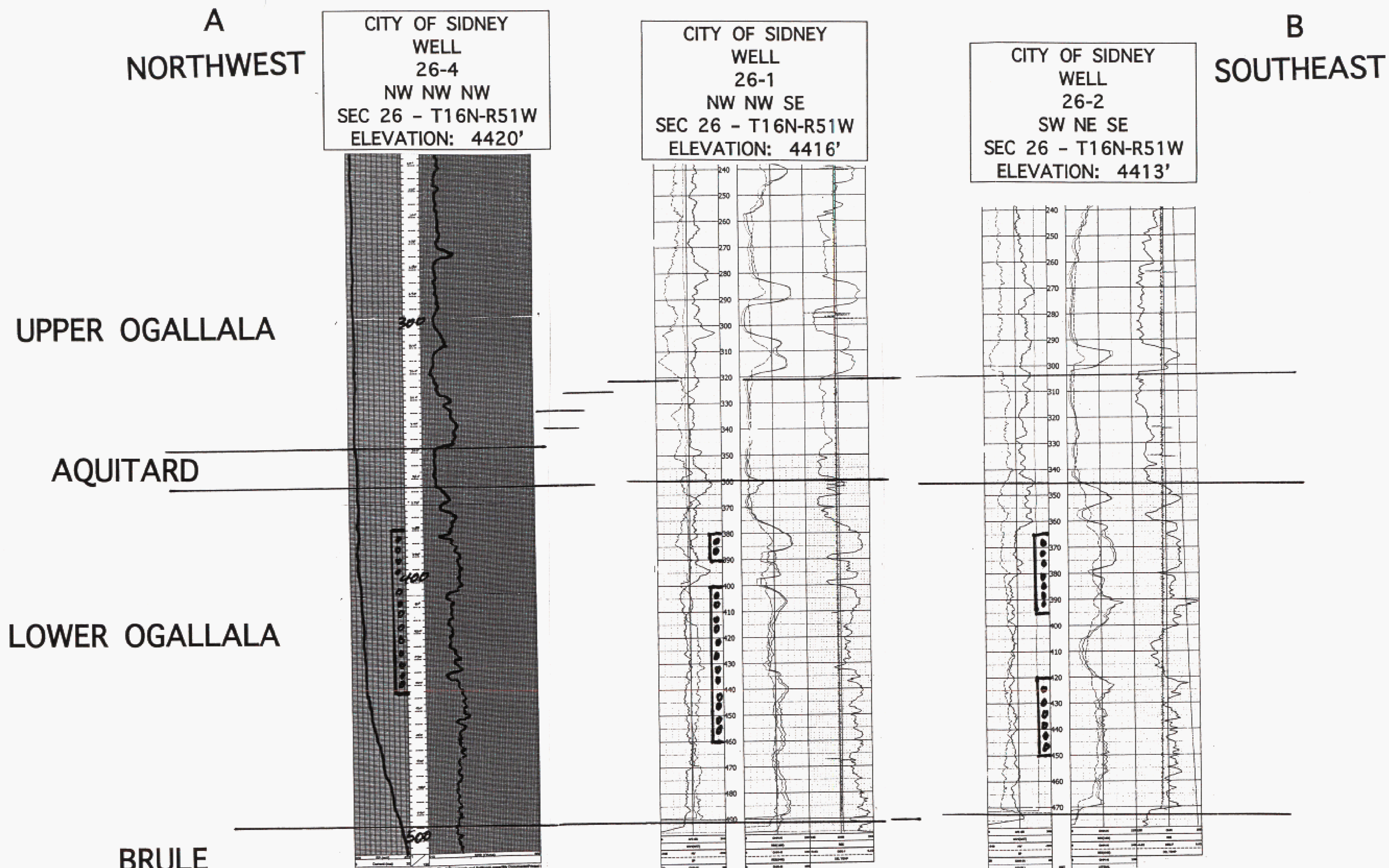
SCALE: 1" = 3000'
JHC PROJ. NO.: 106-46
DRAWN BY: NCH
CHECKED BY: TTS
FIGURE: 1A

Jacobson Helgoth
CONSULTANTS

FILE NO.: DRAWDOWN.DWG

ADDITIONAL INFO. FILED JUL 1 2 2005



GAMMA RAY/SP - RESISTIVITY LOGS

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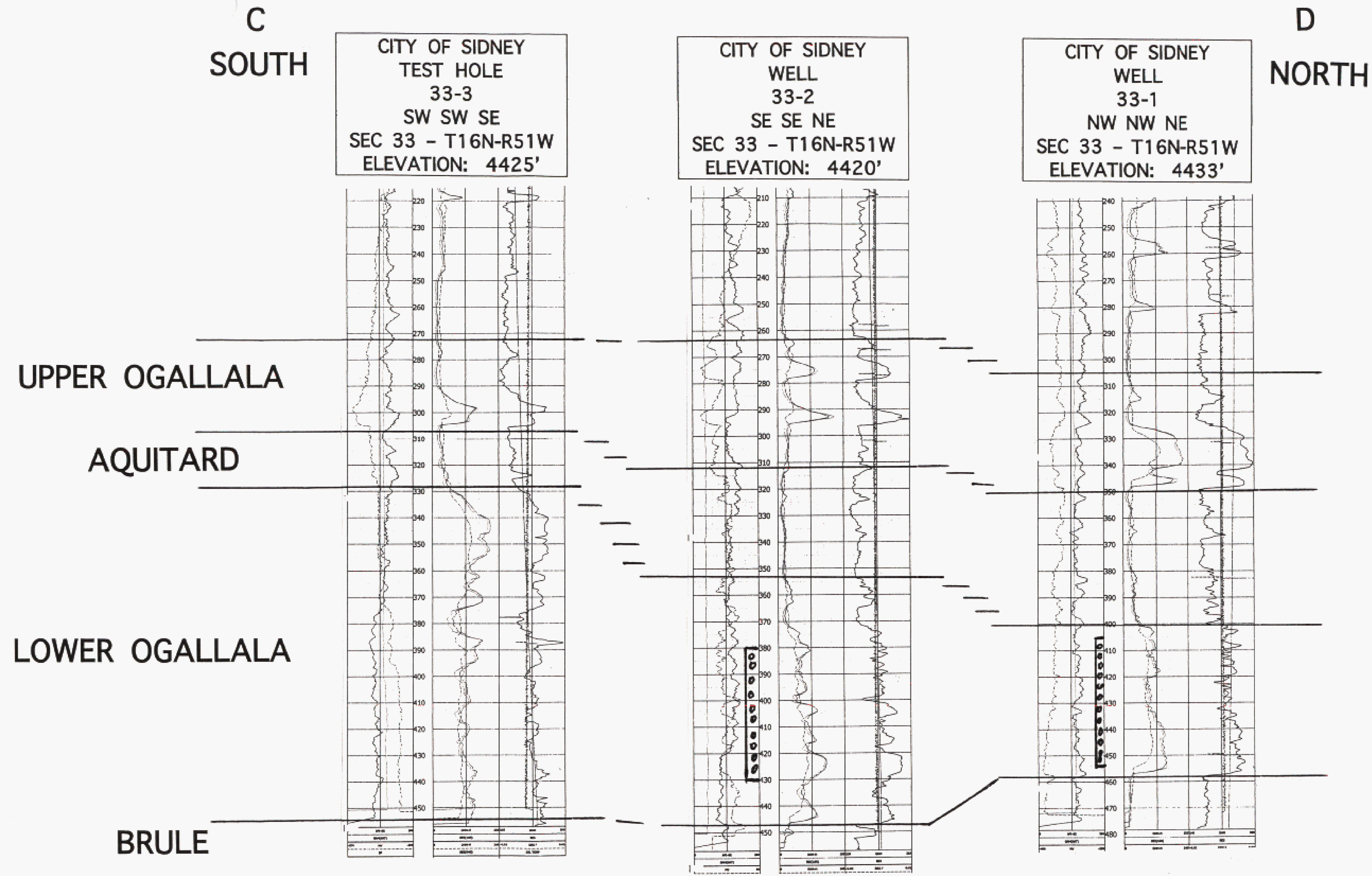

GAMMA RAY/SP - RESISTIVITY LOGS

Jacobson Helgoth CONSULTANTS	Date: 6-15-05	NORTHWEST WELL FIELD GEOLOGIC CROSS SECTION C-D
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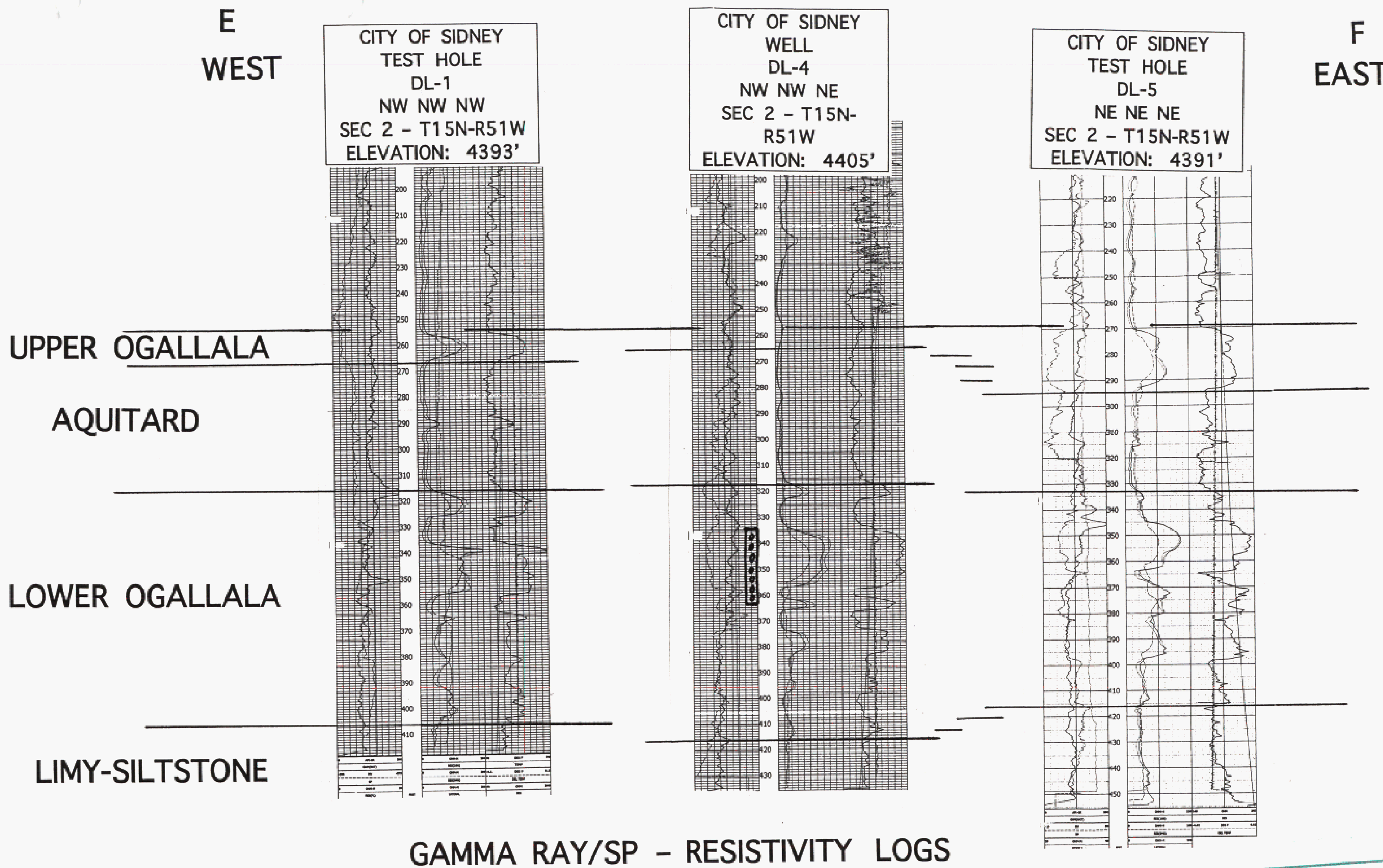
	Checked By: TTS	CITY OF SIDNEY
	Figure: 3A	



Jacobson Helgoth
CONSULTANTS

Date: 6-15-05
Scale: NONE
JHC No.: 106-46
Drawn By: NCH
Checked By: TTS
Figure: 4A

NORTHWEST WELL FIELD
GEOLOGIC CROSS SECTION E-F

CITY OF SIDNEY