

## APT REANALYSIS

SITE: ACME Improvement District  
Section 25, Township 44S, Range 46E

REPORT: Gee & Jenson, Supplementary Engineering Report, Water Supply Development, Section 25, for ACME Improvement District, November, 1980.

GEOLOGIC DATA: Appendix A, pp. 5, 6

Lithologic descriptions included for wells PW 18, 18-1D, 18-2D, 18-3D, TW-13, TW-14, and TW-15. A generalized site lithology based on these descriptions is as follows:

0-5	sand, fine to very fine
5-15	limestone
15-65	sand, fine to very fine
65-115	limestone and sand interlayered
115-125	clayey sand (considered a semi-confining bed)
125-130	limestone with silty clay

Water quality becomes highly mineralized in lowest limestone unit.

Base of the Surficial aquifer estimated at -166 feet NGVD from Miller (1987).

Site elevation is approximately 18 feet NGVD.

Depth to water is approximately 4 feet.

### WELL DESCRIPTIONS:

<u>Well</u>	<u>Diam.</u> <u>(in)</u>	<u>Total</u> <u>Depth</u> <u>(ft)</u>	<u>Cased</u> <u>Depth</u> <u>(ft)</u>	<u>Screen</u> <u>/Open</u>	<u>r</u> <u>(ft)</u>
PW-18	12"	90	70	screen	pumped
TW-13	2"	100	60	screen	
TW-14	2"	100	60	screen	
TW-15	2"	100	55	screen	
18-1S	2"	10	60	screen	33
18-1D	2"	90	70	screen	33
18-2D	2"	90	70	screen	130
18-3D	2"	90	70	screen	200

Wells TW-13, TW-14, and TW-15 were not used in the APT.

INFLUENCING FACTORS: Figures 2 and 3

- 1) There is a drainage ditch located within 10 feet of PW-18 and wells 18-1S and 18-1D. No information is given on the ditch.
- 2) There is a canal located approximately 150 feet south of PW-18 and another canal located about 400 feet west of PW-18. No further information is given on either canal.

APT: pp. 6-8

Start: 9/24/80  
Discharge: 900 GPM to canal 450' away  
Duration: 72 hrs.  
Recovery: 4 hrs.

Water levels were measured in observation wells 18-1S, 18-1D, 18-2D, 18-3D and in the ditch and two canals.

CONSULTANT'S ANALYSIS: pp. 9-13

Method: Boulton Method (Boulton 1963)

Results:

<u>Well</u>	<u>Early Time</u>		<u>Late Time</u>	
	<u>T(GPD/FT)</u>	<u>S</u>	<u>T(GPD/FT)</u>	<u>S</u>
18-1D	33,816	1.6X10 <sup>-2</sup>	-	-
18-2D	49,114	2.5X10 <sup>-4</sup>	46,881	0.26
18-3D	49,114	5.4X10 <sup>-3</sup>	49,114	0.21
Avg.	44,015	5.4X10 <sup>-3</sup>	47,998	0.23

Comments:

- 1) The consultant was unable to fit a late time curve to data from 18-1D. Although data for 18-2D and 18-3D show possible delayed yield, it would also appear difficult to fit.
- 2) Data for 18-1S was collected but not analyzed. A plot of drawdown for 18-1S shows.
- 3) Consultant found poor comparison between actual drawdowns and drawdowns predicted using average values of T, 46,000 GPD/FT, and S, .23.
- 4) Partial penetration and canal leakance were not accounted for.

REANALYSIS:

Method: Neuman (1975)

Results:

	<u>Early Time</u>		
<u>Well</u>	<u>T(FT<sup>2</sup>/DAY)</u>	<u>S</u>	<u>K<sub>D</sub></u>
18-1S	20,000	.0010	.01
18-2D	12,500	.0011	.01
18-3D	12,500	.00065	.01
Avg.	15,000	.0009	.01

Comments:

- 1) Data was used as measured. No canal or drainage ditch recharge corrections were made due to lack of data.
- 2) The time-drawdown curve for well 18-1D was quite flat. Therefore, it was not used in the curve matching.
- 3) Drawdown curves were matched to Neuman curves with beta values chosen so that K<sub>D</sub> would be the same for all wells. Curves were matched for several K<sub>D</sub>'s. A K<sub>D</sub> value of .01 gave the most consistent results between wells.

RECOMMENDED VALUES:

REFERENCES:

Miller, W. L., 1986. Lithology and Base of the Surficial Aquifer System, Palm Beach County, Florida. USGS Water Resources Investigation Report 86-4067.

Neuman, S. P., 1975. Analysis of pumping test data from anisotropic unconfined aquifers considering delayed gravity response. Water Resources Research, Vol. 10, No. 2.



R 41 E

R 42 E

23

24

19



• TW 15

TW 8 •

LAKE WORTH ROAD

T  
44  
S

26

CANAL

• TW 14

25

*Estimated!!  
PW-18  
26° 36' 27"  
80° 13' 13"  
NAD83*

RANGE LINE ROAD (SR-7)

CANAL

30

PW 18

HOMELAND ROAD

TW 13

CANAL

35

36

31

LEGEND

- ✱ EXISTING WELL
- TEST WELL
- OBSERVATION WELL



EXISTING WELL LOCATIONS  
IN SECTION 25

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FIGURE 2



WELL CONSTRUCTION

Well No. Observation 18-2D  
Driller: Alsay-Pippin  
Samples: Cuttings X, Core \_\_\_\_\_  
Casing: Depth 70 feet  
Diameter 2 inches  
Material Schedule 40

Location: Acme Improvement District  
Recorded by: GR  
Date Drilled: September 15, 1980  
Screen: Depth 70-90 feet  
Diameter 2 inches  
Material Schedule 40, PVC #40 Slot

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

0-15

Shell-white, gastropods and pelecypods, whole fragmental, poorly consolidated, 80%.

Sand-silica, light brown, fine grained, 10%.

Limestone-intrabiosparite, light gray to gray, composed of medium to fine grained silica sand and shell fragments, lithified, 10%.

15-45

Sand-silica, light brown, fine to very fine grained, trace of fine fragmented white shell fragments, unconsolidated.

45-62

Sand-silica, brownish white, fine grained to silt sized grains, trace of black fine grained phosphate particles, unconsolidated.

62-80

Limestone-intrabiosparite, dark gray, composed of fine grained silica sand and white shell fragments, lithified concretions, 60%.

Sand-silica and carbonate, very fine to fine grained, abundant, very fine grained, black phosphate particles, unconsolidated, 40%.

80-90

Limestone-intrabiosparite, dark gray, composed of fine grained silica sand and white shell fragments with a sparry calcite cement, lithified, 70%.

Sand and Shell-fine grained silica and carbonate sand, and light brown pelecypod fragments, unconsolidated, 30%.



WELL CONSTRUCTION

Well No. <u>Observation Well 18-3D</u>	Location <u>Acme Improvement District</u>
Driller: <u>Alsay-Pippin</u>	Recorded by: <u>GR</u>
Samples: Cuttings <u>X</u> , Core _____	Date Drilled: <u>September 16, 1980</u>
Casing: Depth <u>70 feet</u>	Screen: Depth <u>70-90 feet</u>
Diameter <u>2 inches</u>	Diameter <u>2 inches</u>
Material <u>Schedule 40 PVC</u>	Material <u>Schedule 40 PVC, #40</u>

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

0-15	Shell-white, gastropods and pelecypods, whole and fragmental, poorly consolidated, 80%  Sand-silica, light brown, fine grained, 10%.  Limestone - intrabiosparite, light gray to gray, composed of medium to fine grained silica and shell fragments, lithified, 10%.
15-45	Sand-silica, light brown, fine to very fine grained, trace of fine fragmented white shell fragments, unconsolidated.
45-62	Sand-silica, brownish white, fine grained to silt sized grains, trace of black fine grained phosphate particles, unconsolidated.
62-80	Limestone-intrabiosparite, dark gray, composed of fine grained silica sand and white shell fragments, lithified concretions, 60%.  Sand-silica and carbonate, very fine to fine grained abundant very fine grained black phosphate particles, unconsolidated 40%.
80-90	Limestone-intrabiosparite, dark gray, composed of fine grained silica sand and white shell fragments with a sparry calcite cement, lithified 70%.  Sand and Shell-fine grained silica and carbonate sand and light brown pelecypod fragments, unconsolidated 30%.



WELL CONSTRUCTION

Well No. Test Well #13 (TW-13)  
 Driller: Alsay-Pippin  
 Samples: Cuttings \_\_\_\_\_, Core \_\_\_\_\_  
 Casing: Depth 130 filled to 100 feet  
           Diameter 2 inches  
           Material Schedule 40 PVC

Location: Acme Improvement District  
 Recorded by: GR  
 Date Drilled: July 28, 1980  
 Screen: Depth 60-130 feet  
           Diameter 2 inches  
           Material Schedule 40 PVC #40 Slot

DEPTH BELOW  
 LAND SURFACE  
 (FEET)

LITHOLOGY DESCRIPTION

0-20	Sand-silica, brown, fine grained, abundant white pelecypods and gastropods, some small limestone fragments, unconsolidated.
20-30	Sand-silica, light brown, fine to medium grained, 70 percent fines, trace of white shell fragments, unconsolidated.
30-50	Sand-silica, very fine to fine grained, light brown, trace of white shell fragments, unconsolidated.
50-62	Sand-silica, very fine to fine grained, light brown, off white shell fragments, unconsolidated, trace of very fine grained phosphate sand.
62-68	Limestone-phosphatic intrabiosparite with lenses of micrite, dark gray to very light brown, some recrystallization and trace of white shell fragments, lithified.
68-79	Limestone-phosphatic intrabiosparite, dark gray abundant recrystallization, abundant pelecypod and gastropod fragments, well lithified.
79-95	Limestone-same as above, but no gastropods and more dense.
95-110	Limestone-phosphatic intrabiosparite, dark gray, abundant recrystallization, abundant pelecypod and gastropod fragments, well lithified, with lens of micrite (3') at 100 feet and an increase in recrystallization of pelecypods.



WELL CONSTRUCTION

Well No. <u>Test Well 13 (TW-13)</u>	Location: <u>Acme Improvement District</u>
Driller: <u>Alsay-Pippin</u>	Recorded by: <u>GR</u>
Samples: Cuttings _____, Core _____	Date Drilled: <u>July 28, 1980</u>
Casing: Depth <u>130 filled to 100 feet</u>	Screen: Depth <u>60-130 feet</u>
Diameter <u>2 inches</u>	Diameter <u>2-inches</u>
Material <u>Schedule 40 PVC</u>	Material <u>Schedule 40 PVC #40 S</u>

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

110-120

Limestone-dark gray intrabiosparite interbedded with micrite, abundant shell and silty white clay, barnacle fragments, coral polyps and Echinoderm spines.

120-130

Silty clay, lime mud, carbonate sand, grayish white, trace of phosphate particles with some sparite and micrite.



WELL CONSTRUCTION

Well No. <u>Test Well #15 (TW-15)</u>	Location: <u>Acme Improvement District</u>
Driller: <u>Alsay-Pippin</u>	Recorded by: <u>GR</u>
Samples: Cuttings _____, Core _____	Date Drilled: <u>July 31, 1980</u>
Casing: Depth <u>130 filled to 100 feet</u>	Screen: Depth <u>60-130 feet</u>
Diameter <u>2 inches</u>	Diameter <u>2 inches</u>
Material <u>Schedule 40 PVC</u>	Material <u>Schedule 40 PVC #40 Slot</u>

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

0-14	Sand-silica, dolomitic limestone and micrite and abundant shell, light brown, (fill from adjacent canal).
14-50	Sand-silica, light brown, fine to very fine grained, trace of fine to medium grained shell fragments, unconsolidated.
50-56	Sand-silica, light gray, fine to very fine grained, abundant fine grained phosphate, trace of shell fragments, unconsolidated.
56-70	Limestone-gray intrabiosparite, phosphatic, trace of micritic limestone, (bio), lithified.
70-79	Limestone-gray intrabiosparite, phosphatic, trace micritic limestone (bio), lithified; trace of silty white clay and micrite.
80-	Shell-lense, gastropods, pelecypods and abundant clay.
81-90	Limestone: gray intrabiosparite, phosphatic, trace of micritic limestone lithified, with a trace of shell fragments.
90-98	Same as above with an increase in shell fragments, pelecypods and gastropods.
98-100	Sand-silica, carbonate sand, fine grained shell fragments, abundant phosphate, light gray, trace of silty clay, unconsolidated.
100-107	Sand-silica, some carbonate, fine grained shell fragments, abundant phosphate, light gray, trace of silty clay, unconsolidated.
107-110	Shell-white to light brown, pelecypod and gastropod fragments, poorly consolidated.

WELL CONSTRUCTION

Well No. Test Well #15 (TW-15)  
 Driller: Alsay-Pippin  
 Samples: Cuttings \_\_\_\_\_, Core \_\_\_\_\_  
 Casing: Depth 130 filled to 100 feet  
           Diameter 2 inches  
           Material Schedule 40 PVC

Location: Acme Improvement District  
 Recorded by: GR  
 Date Drilled: July 31, 1980  
 Screen: Depth 60-130 feet  
           Diameter 2 inches  
           Material Schedule 40 PVC #30 SI

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

110-120	Limestone-biointramicrite, light brown, abundant pelecypods and gastropods, abundant silty clay, poorly lithified, trace of phosphate.
120-132	Limestone-intrabiomicrite, light gray, abundant phosphate and silty white clay, trace of pelecypods, poorly lithified.



WELL CONSTRUCTION

Well No. Test Well #14 (TW-14) Location: Acme Improvement District  
 Driller: Alsay-Pippin Recorded by: GR  
 Samples: Cuttings, Core \_\_\_\_\_ Date Drilled: July 30, 1980  
 Casing: Depth 130 filled to 100 feet Screen: Depth 60-130 feet  
 Diameter 2 inches Diameter 2 inches  
 Material Schedule 40 PVC Material Schedule 40 PVC #40 Slot

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

0-26 Sand-silica, shell, white, fine grained, abundant carbonate sand, 60 percent pelecypods, minor gastropods, fill from adjacent ditch, unconsolidated.

26-40 Sand-silica, brown, fine to very fine grained, minor fine grained shell fragments, unconsolidated.

40-67 Sand-silica, light brown, fine to very fine grained, minor fine grained shell fragments, unconsolidated.

67-69 Dolomitic limestone and limestone, brown and gray, some silica sand.

69-75 Limestone-intrabiosparite, gray, phosphatic grains, hardness increases, well lithified.

75-80 Limestone-same as above, but calcite crystals and calcite replacement in pelecypods is minor, also had an increase in fluid loss.

80-85 Limestone-same as above, but harder and fluid loss.

85-90 Limestone-same as above, but hit a 2 foot seam of micrite.

90-109 Limestone-same as above, but a little darker due to phosphate in a few spots.

109-120 Limestone-biosparite, shell fragments and Echinoderm fragments lithified with a sparite/calcite cement, white, density increases and much less fluid loss; abundant white silty clay and micrite.

120-130 Sand-silty, lime mud, shell fragments (mainly pelecypods) minor phosphate and micrite and sparite, loosely consolidated, in places.

80-196



WELL CONSTRUCTION

Well No. Observation Well 18-1D
Driller: Alsay-Pippin
Samples: Cuttings X, Core
Casing: Depth 70 feet
Diameter 2 inches
Material Schedule 40 PVC

Location: Acme Improvement District
Recorded by: GR
Date Drilled: September 15, 1980
Screen: Depth 70-90 feet
Diameter 2 inches
Material Schedule 40 PVC, #40 Sld

DEPTH BELOW LAND SURFACE (FEET)

LITHOLOGY DESCRIPTION

- 0-2 Sand-silica, light brown, fine grained, trace of very fine grained shell fragments, unconsolidated.
2-10 Limestone-intrabiomicrite, grayish brown, fine grained silica sand and micritic cement matrix surrounding abundant pelecypods and gastropods, poorly lithified.
10-20 Sand-silica, brown, fine to very fine grained, subangular, unconsolidated, 70%. Shell-white pelecypods and gastropods, large to small, whole and fragmented, 30%.
20-35 Sand-silica, light brown, fine to very fine grained, subangular, abundant pelecypod fragments, unconsolidated.
35-60 Sand-silica, very light brown, fine to very fine grained, subangular to subrounded, trace of white shell fragments, unconsolidated.
60-65 Sand-silica, very light gray brown, fine to very fine grained, subangular to subrounded, trace of black fine grained phosphate particles, unconsolidated.
65-70 Limestone-intrabiosparite, dark gray, pelecypod fragments incorporated in limestone, very fine grained phosphate particles present in silica sand matrix, lithified.
70-85 Limestone-intrabiosparite, same as above but minor large (less than 1 mm) calcite crystals present.
85-90 Limestone-intrabiosparite, light gray, same as 65-70 but surrounded by a matrix of pelecypod and gastropod fragments and carbonate sand, the limestone occurs as individual concretionary bodies, limestone is lithified but the sand and shell matrix is consolidated.



WELL CONSTRUCTION

Well No. PW 18 (Test Supply Well #18)  
 Driller: Alsay-Pippin  
 Samples: Cuttings     X    , Core       
 Casing: Depth 70 feet  
 Diameter Outer - 18 inches  
           Inner - 12 inches  
 Material Outer - Steel  
           Inner - Schedule 80 PVC

Location: Acme Improvement District  
 Recorded by: GR  
 Date Drilled: August 15, 1980  
 Screen: Depth 70-90 feet  
           Diameter 12 inches  
           Material Telescope Size  
                   SS, #100 Slot

DEPTH BELOW  
LAND SURFACE  
(FEET)

LITHOLOGY DESCRIPTION

0-5	Sand-silica, white, very fine to silt sized grains, trace of organics, unconsolidated.
5-10	Limestone-intrasparite, light gray, cemented fine grained silica sand with pelecypod fragments, abundant, consolidated.
10-15	Limestone-same as above but increase in unconsolidated sand fraction and calcite crystals.
15-20	Sand-silica light brown very fine grained, abundant white pelecypod shells, 15% intraspartite limestone.
20-25	Same as above.
25-60	Sand-silica, light brown, fine to silt sized grains, trace of white shell fragments, unconsolidated.
60-62	Sand-silica, and intramicritic limestone, white, consolidated and unconsolidated layers.
62-66	Limestone-intrabiosparite, gray, phosphatic, trace of shell fragments, well lithified.
66-68	Limestone-intrabiosparite, gray, mixed with a intramicrite, much softer, poorly lithified.
68-85	Limestone-intrabiosparite, gray, phosphatic, hard, trace of shell fragments, trace of dolomitic limestone, increase in hardness at 80 feet, well lithified.
85-90	Limestone and shell-intrabiosparite, gray with shell lenses, shell is composed of pelecypods and gastropods, trace of medium grained silica sand, limestone is lithified and shell if poorly consolidated.



### 5.3 Results

Observed water levels in the observation wells were collected, reduced and plotted on double logarithmic drawdown vs. time plots for matching the Boulton type curves (Figures 6, 7, and 8). All raw field data has been included in Appendix B. Transmissivity and storage coefficient determinations were made for each of the deep observation wells. Table 2 summarizes the results. Early time results show confined and semi-confined storage coefficient values with an average value of  $5.4 \times 10^{-2}$  due to incomplete dewatering. During this early period of pumping, water is released instantaneously from storage by the compaction of the water and the curve conforms to the Theis curve. During the second segment, the effects of gravity drainage are felt and the slope of the curve decreases relative to the Theis curve due to dewatering of the falling water table. The third segment occurring at later times, once again conforms to the Theis curve. Late time data gave average storage coefficient values of 0.23 which is as expected for an unconfined system. The average transmissivity value for all analyses is about 46,000 gpd/ft. It must be recognized that a considerable range may exist, between 34,000 gpd/ft and 50,000 gpd/ft depending on specific conditions and the method of analysis utilized.



Drawdowns can be calculated based upon the calculated values of  $T = 46,000$  gpd/ft and  $S = 0.23$ . These drawdowns were found to be a poor match with the actual drawdowns measured in the field. The lithology in the area indicated water table conditions (refer to Section 4.0 and Appendix A for descriptions). In designing well field systems, conservative values for the aquifer parameters are generally chosen. In this case  $T = 34,000$  gpd/ft and  $S = 0.1$  were found to give reasonably close approximations to field data after three days of pumping. Table 3 shows a comparison of the calculated vs. field drawdowns.

Carrying the analysis further, drawdowns for various intervals of time were calculated. The intervals used were 1 day, 3 days and 30 days, assuming continuous pumping at 900 gpm and no recharge to the system. This extrapolated data is used in a later section to design the wellfield and determine impacts. The drawdown vs. distance data is then plotted in Figure 9 giving a graphical representation of the cone of influence at 900 gpm. In Table 3 it should be noted that although the calculated data after three days of pumping closely resembles the field drawdown data, the system appears to have reached near equilibrium after one day of pumping according to the field data. This is further indication that the projected drawdowns are very conservative and represent worst case conditions for design purposes.



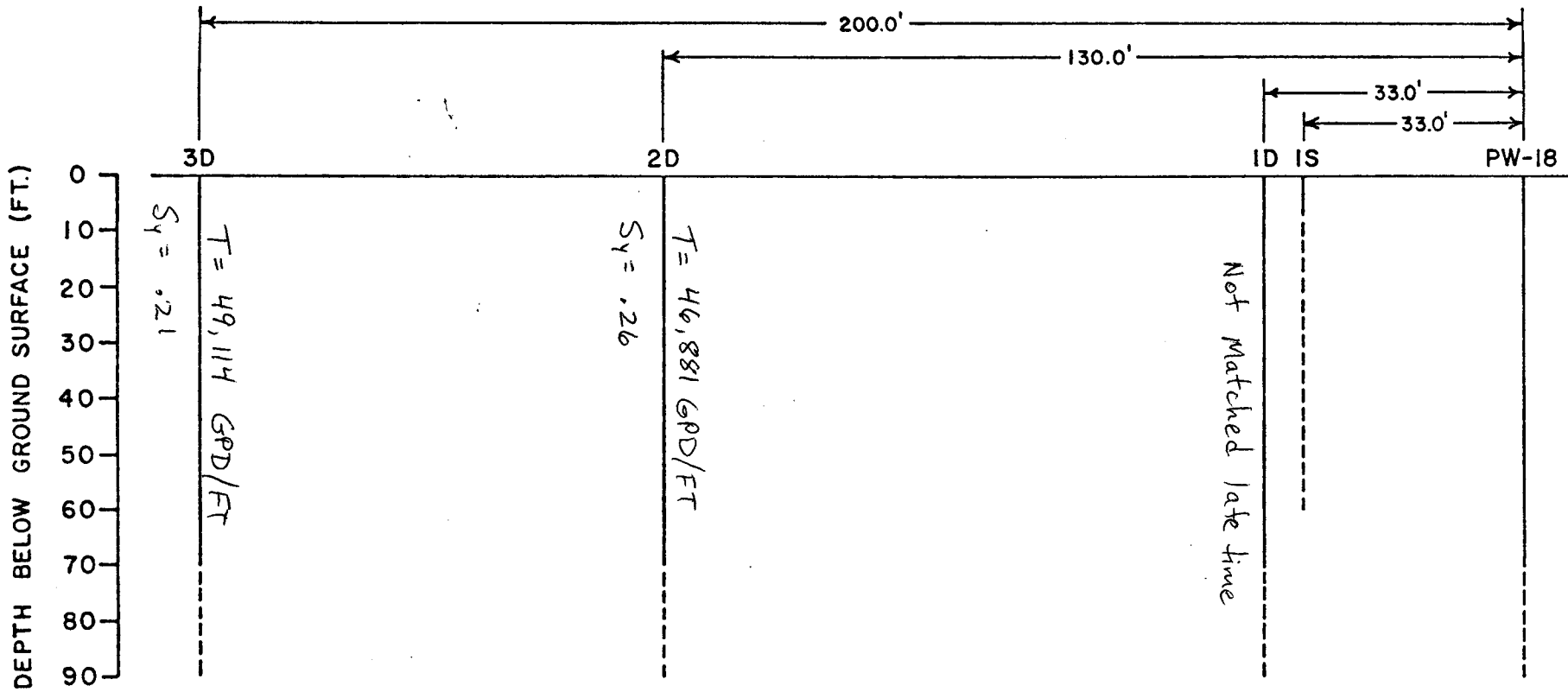


## 6.0 WATER QUALITY

Four test wells (Test Wells 8, 13, 14 and 15) had been drilled in Section 25 prior to construction of Test Supply Well No. 18. Each of these wells showed potable water extending to a depth of approximately 120 feet. Below 120 feet, these test wells produced highly mineralized water under artesian pressure. A low permeability clayey sand (at 100 to 120 feet below lsd appears to act as a confining or semi-confining bed, maintaining this highly mineralized water below it. To avoid vertical migration of this saline water, each of these wells were plugged with grout to 100 feet. Conductivities of 500 to 700 umhos/cm was produced from each of these wells after plugging.

PW 18 was constructed with screen from 70 to 90 feet. Water quality samples were collected from the discharge during the 72 hour aquifer performance test and analyzed for standard potable mineral concentrations (Appendix C). One sample was taken one hour after pumping began at a rate of 900 gpm.

Boylton Analysis (No accounting for nearby canal or partial pen.)  
Raw data available

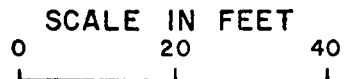


LEGEND

- 2D WELL NO.
- CASED INTERVAL
- - - SCREENED INTERVAL

$T = 47,998$  GPD/FT

$S_y = .23$

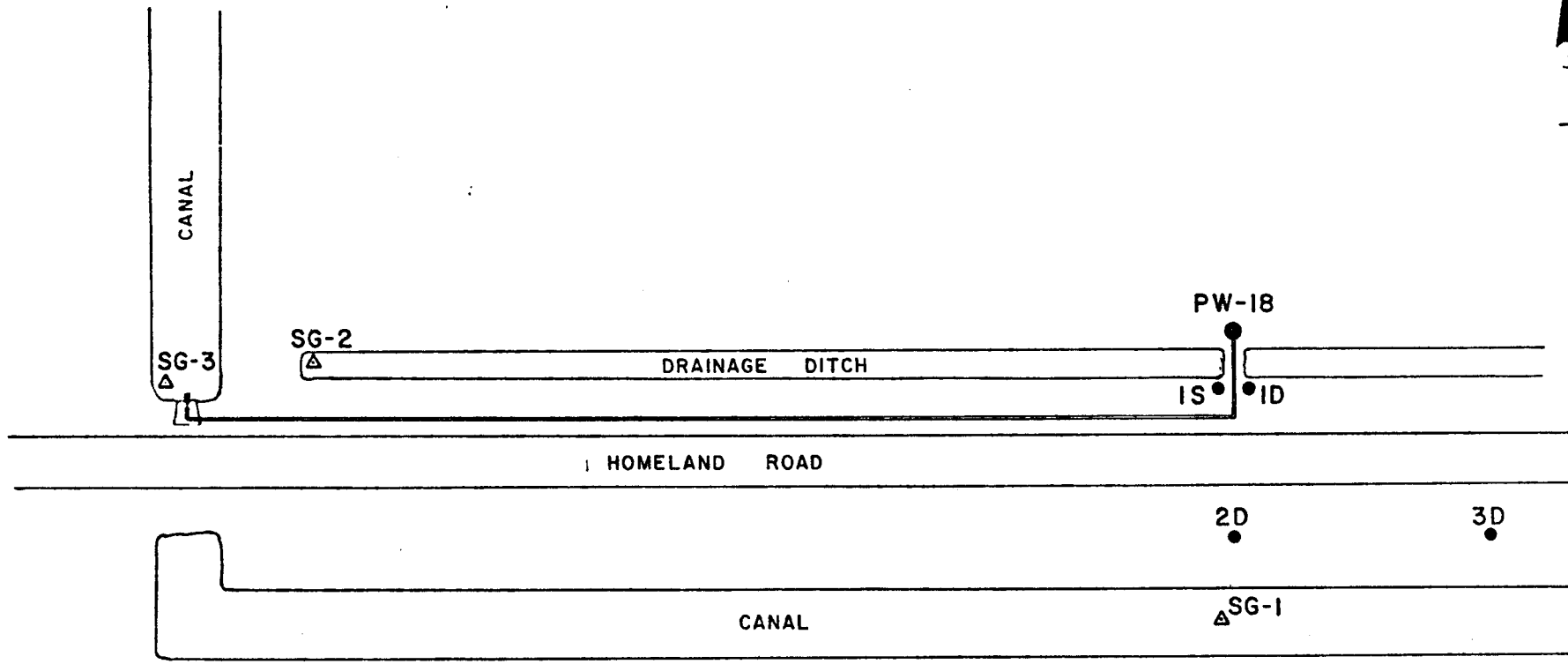


$Q = 900$  GPM

72 hour test

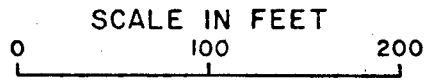
SCHMATIC OF AQUIFER  
TEST WELL LOCATIONS  
AND CONSTRUCTION  
CROSS SECTION

PB120



LEGEND

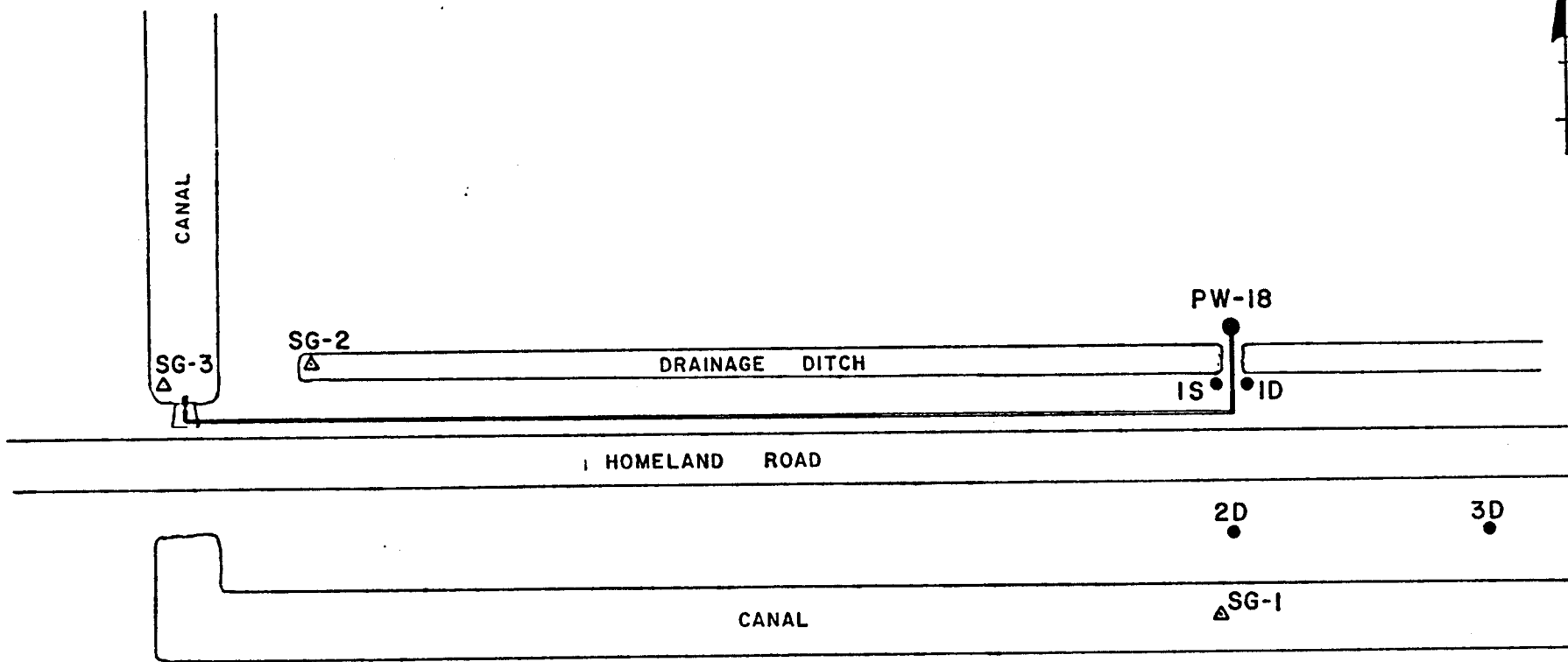
- DISCHARGING WELL
- OBSERVATION WELL (D=DEEP, S=SHALLOW)
- △ STAFF GAGE
- DISCHARGE LINE



AQUIFER TEST INSTRUMENTATION  
LAYOUT - PLAN VIEW

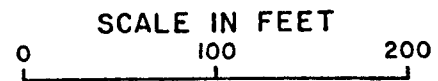
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WEST PALM BEACH, FLORIDA

FB120  
FIGURE 3



LEGEND

- DISCHARGING WELL
- OBSERVATION WELL (D=DEEP, S=SHALLOW)
- △ STAFF GAGE
- DISCHARGE LINE



AQUIFER TEST INSTRUMENTATION  
LAYOUT - PLAN VIEW

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WEST PALM BEACH, FLORIDA

FIGURE 3

R 41 E

R 42 E

23

24

19

N



• TW 15

TW 8 •

LAKE WORTH

ROAD

T

44

26

CANAL

• TW 14

25

RANGE LINE ROAD (SR-7)

CANAL

30

S

PW 18



HOMELAND ROAD

TW 13



CANAL

35

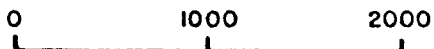
36

31

LEGEND

- ✱ EXISTING WELL
- TEST WELL
- ◊ OBSERVATION WELL

SCALE IN FEET



EXISTING WELL LOCATIONS  
IN SECTION 25

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PB120

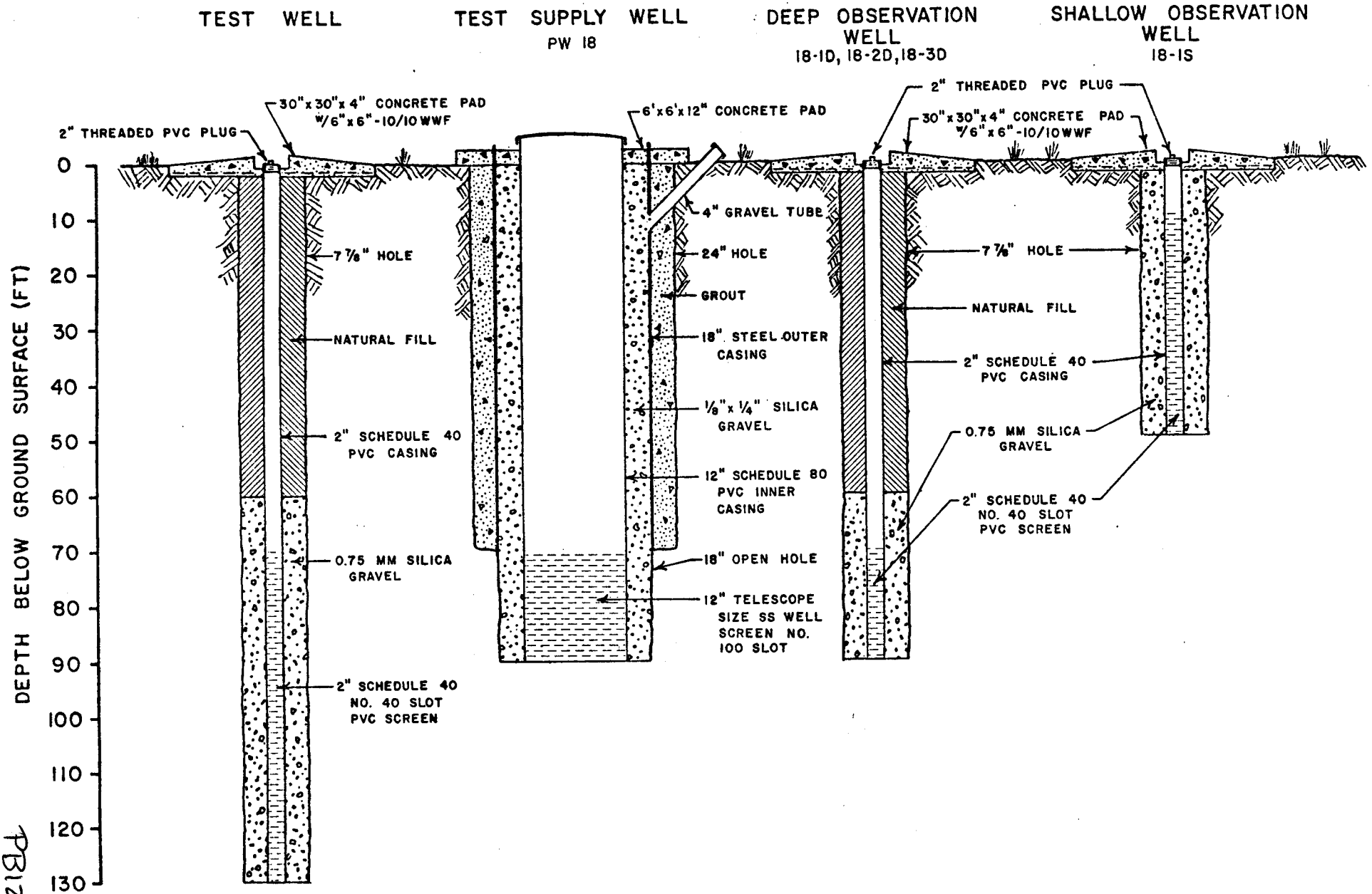
FIGURE 2



TABLE 1  
WELL CONSTRUCTION DATA

<u>Well No.</u>	<u>Diameter (in.)</u>	<u>Cased Depth (ft.)</u>	<u>Screened Interval (ft.)</u>	<u>Total Depth (ft.)</u>	<u>Date Drilled</u>
TW 13	2	60	60-130	100*	7-28-80
TW 14	2	60	60-130	100*	7-30-80
TW 15	2	55	55-130	100*	7-31-80
18-1S	2	10	10-60	60	9-12-80
18-1D	2	70	70-90	90	9-11-80
18-2D	2	70	70-90	90	9-15-80
18-3D	2	70	70-90	90	9-16-80
PW-18	outer 18 inner 12	outer 71 inner 70	70-90	90	9-10-80

\* grouted up to 100 feet

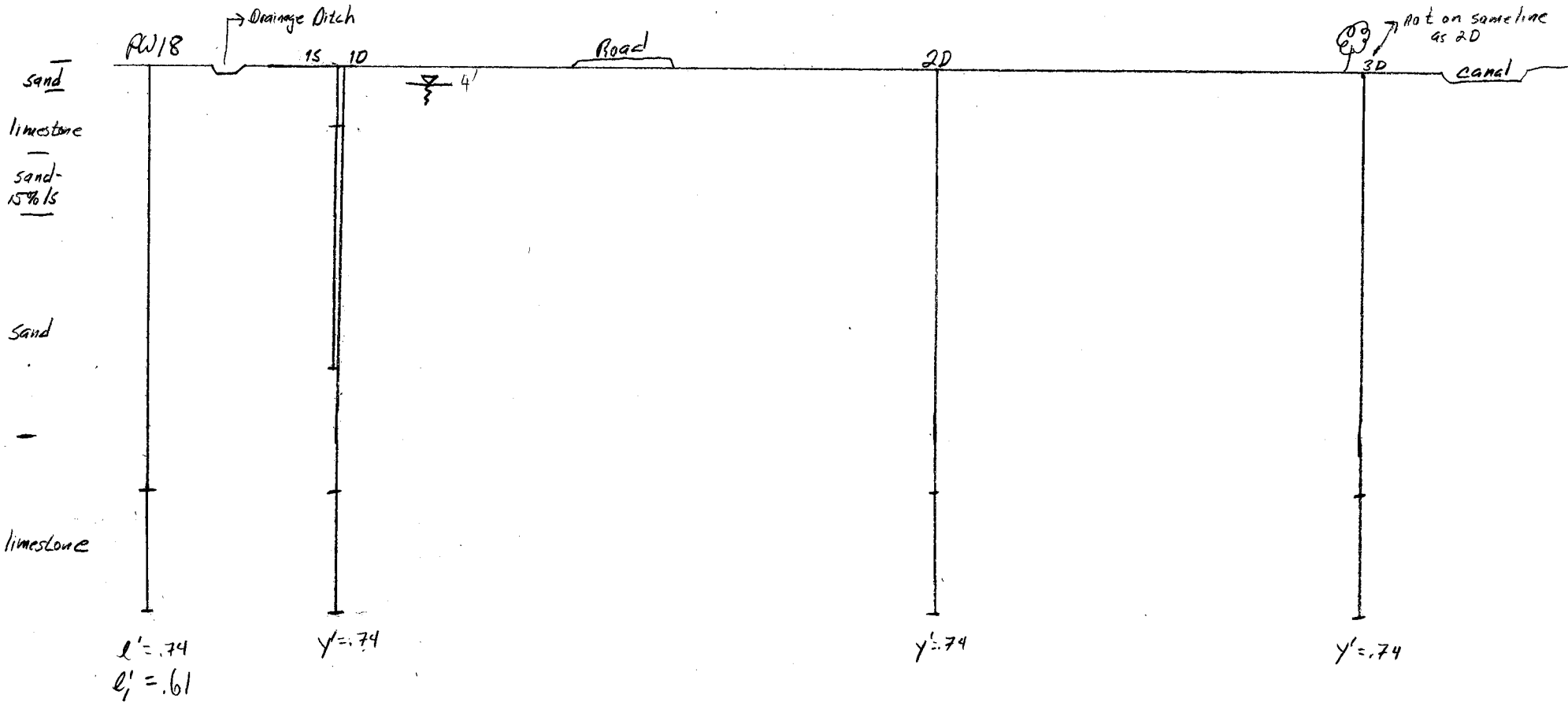


**TYPICAL WELL CONSTRUCTION**

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.  
WEST PALM BEACH, FLORIDA

# Acme Improvement ART

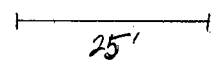
$Q = 900 \text{ gpm}$  Duration = 72 hrs.



saturated thickness = 116'

— assumed aquifer bottom based on lithologic logs

$b = 116'$





# ACME Improvement APT

Well	$\beta$	T (FT <sup>3</sup> /DAY)	S	K <sub>D</sub>
18-1S	.009			.1
18-2D	.14			.1
18-3D	.3	No Match		.1
18-1S	.0009	20,000	.0010	.01
18-2D	.014	12,500	.0011	.01
18-3D	.03	12,500	.00065	.01
18-1S	.045			.05
18-2D	.07			.05
18-3D	.15			.05

42,881 50 SHEETS 3 SQUARE  
 42,882 100 SHEETS 3 SQUARE  
 42,883 150 SHEETS 3 SQUARE  
 42,884 200 SHEETS 3 SQUARE  
 MADE IN U.S.A.





TABLE 2  
SUMMARY OF AQUIFER PARAMETERS

Boulton Method of Analysis

<u>Well No.</u>	<u>Early Time</u>	
	<u>Transmissivity</u> (gpd/ft)	<u>Storage</u> <u>Coefficient</u>
18-1D	33,816	$1.6 \times 10^{-2}$
18-2D	49,114	$2.5 \times 10^{-4}$
18-3D	<u>49,114</u>	<u><math>1.1 \times 10^{-5}</math></u>
Average	44,015	$5.4 \times 10^{-3}$

<u>Well No.</u>	<u>Late Time</u>	
	<u>Transmissivity</u> (gpd/ft)	<u>Storage</u> <u>Coefficient</u>
18-1D	*	*
18-2D	46,881	0.26
18-3D	<u>49,114</u>	<u>0.21</u>
Average	47,998	0.23

Average transmissivity (Early Time and Late Time) = 46,000 gpd/ft

\*Late Time could not be calculated

TABLE 3

COMPARISON OF CALCULATED  
VERSUS FIELD DRAWDOWN DATA

$$u = \frac{1.87^2 S}{Tt}$$

$$s = \frac{114.6 Q}{T} W(u)$$

T = 34,000  
S = 0.1  
Q = 900 gpm

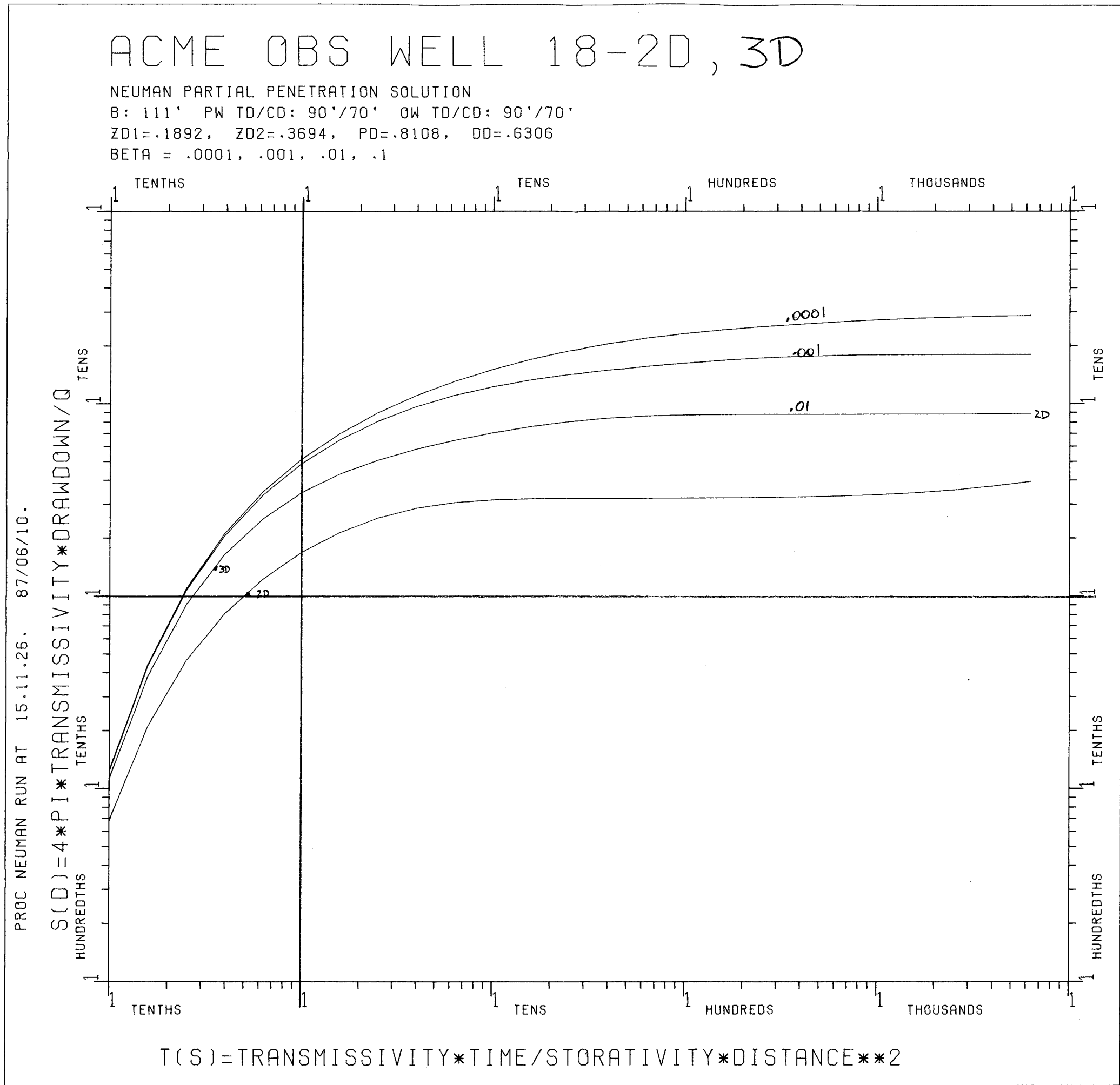
t (days)	18-1D r = 33 ft	18-2D r = 130 ft	18-3D r = 200 ft	r = 500 ft	r = 1,000 ft	r = 2,000 ft
1	u = 6.0 x 10 <sup>-3</sup> W(u) = 4.55 s = 13.80ft(16.34)*	u = 9.3 x 10 <sup>-2</sup> W(u) = 1.89 s = 5.73ft(7.96)*	u = 1.6 x 10 <sup>-1</sup> W(u) = 1.41 s = 4.28ft(6.02)*	u = 1.38 W(u) = 0.12 s = 0.36 ft	u = 5.5 W(u) = 0.0006 s = 1.82 x 10 <sup>-3</sup> ft	-
3	u = 1.5 x 10 <sup>-3</sup> W(u) = 5.93 s = 18.00ft(16.80)*	u = 2.3 x 10 <sup>-2</sup> W(u) = 3.22 s = 9.77ft(8.22)*	u = 5.4 x 10 <sup>-2</sup> W(u) = 2.40 s = 7.28ft(6.30)*	u = 4.58 x 10 <sup>-1</sup> W(u) = 0.61 s = 1.85ft	u = 1.83 W(u) = 0.06 s = 0.18 ft	-
30	u = 2.0 x 10 <sup>-4</sup> W(u) = 7.94 s = 24.09ft	u = 3.1 x 10 <sup>-3</sup> W(u) = 5.2 s = 15.77ft	u = 7.3 x 10 <sup>-3</sup> W(u) = 4.35 s = 13.19ft	u = 4.58 x 10 <sup>-2</sup> W(u) = 2.55 s = 7.74ft	u = 1.83 x 10 <sup>-1</sup> W(u) = 1.31 s = 3.97 ft	u = 1.36 W(u) = 0.12 s = 0.36ft

\* Field drawdown data obtained from data sheets in Appendix B.

Run Neumas using site averages  
and .1 anisotropy / .01 anisotropy  
Vary anisotropy in Neumas

Run Neumas using site averages for  
18-15  
18-2D, 3D, 1D  $K_h = 150$

WMD TAPENO 6108 PLOT NO 0057  
USER NO PALM3D DATE 87/06/10 TIME 16:13



TAPENO 6350 PLOT NO 0032  
USER NO SHINE DATE 87/11/19 TIME 10:29

PROC NEUMAN RUN AT 10.13.58. 87/11/19.

# ACME 18-1S

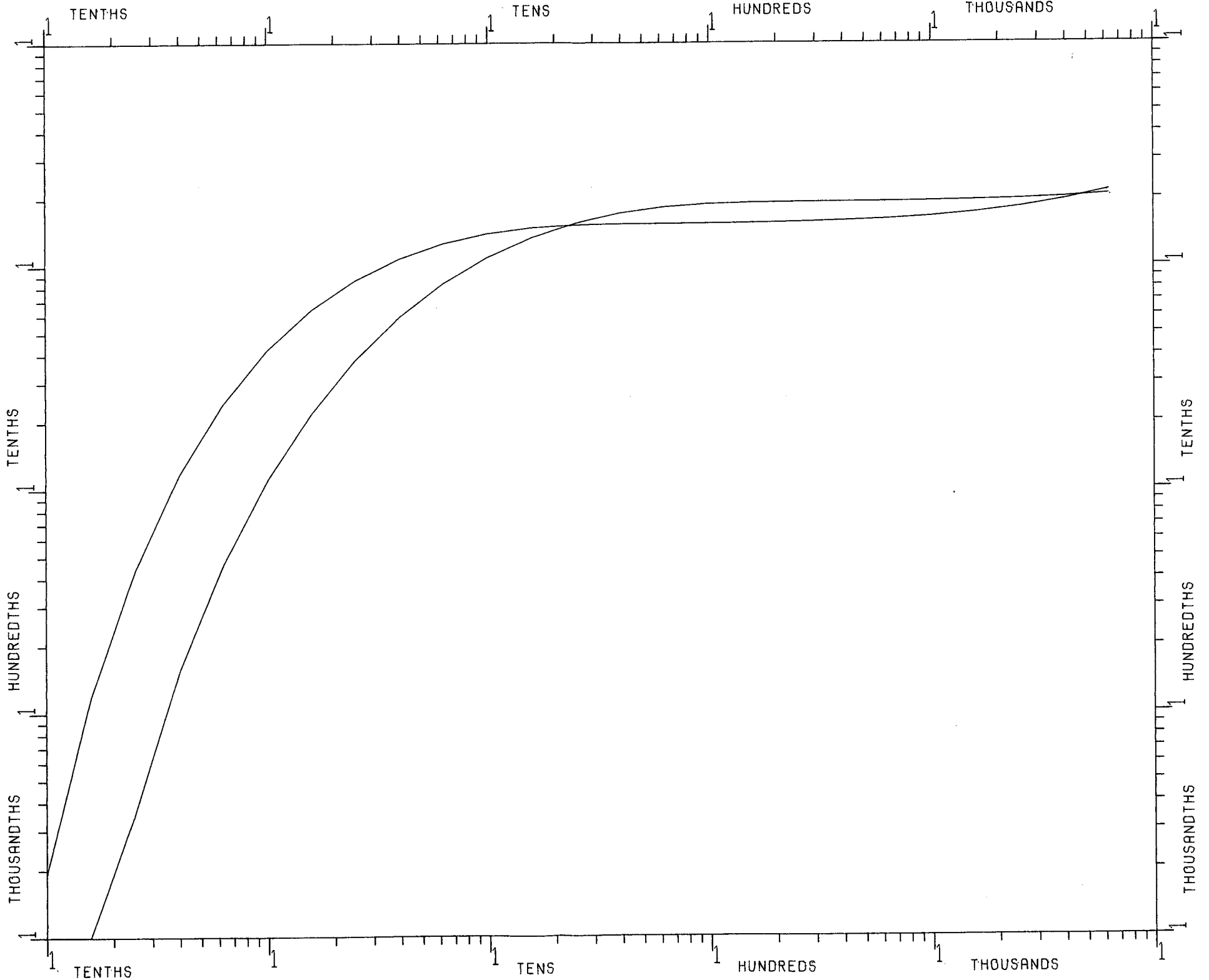
NEUMAN PARTIAL PENETRATION SOLUTION

B: 111' PW TD/CD: 86'/66' OW TD/CD: 56'/6'

ZD1=.4955, ZD2=.9459, PD=.7748, DD=.5946

BETA = .045, .009

$S(D) = 4 * \pi * \text{TRANSMISSIVITY} * \text{DRAWDOWN} / Q$



WMD

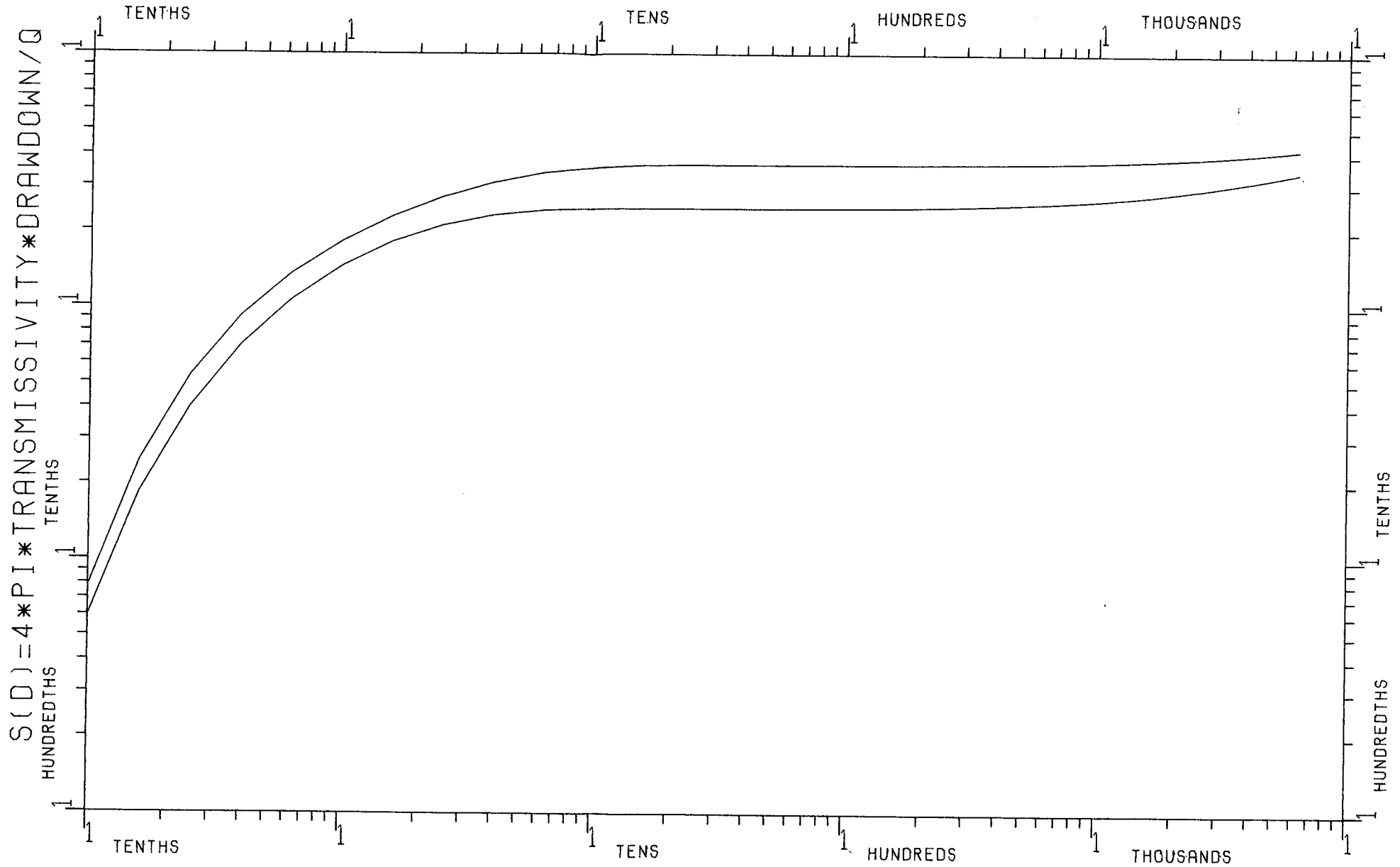
TAPENO 6350 PLOT NO 0029  
USER NO SHINE DATE 87/11/19

TIME 10:25

# ACME DEEP OBS WELLS

NEUMAN PARTIAL PENETRATION SOLUTION  
B: 111' PW TD/CD: 86'/66' OW TD/CD: 86'/66'  
ZD1=.2252, ZD2=.4054, PD=.7748, DD=.5946  
BETA = .07, .15

PROC NEUMAN RUN AT 10.12.50. 87/11/19.



$$T(S) = \text{TRANSMISSIVITY} * \text{TIME} / \text{STORATIVITY} * \text{DISTANCE} ** 2$$

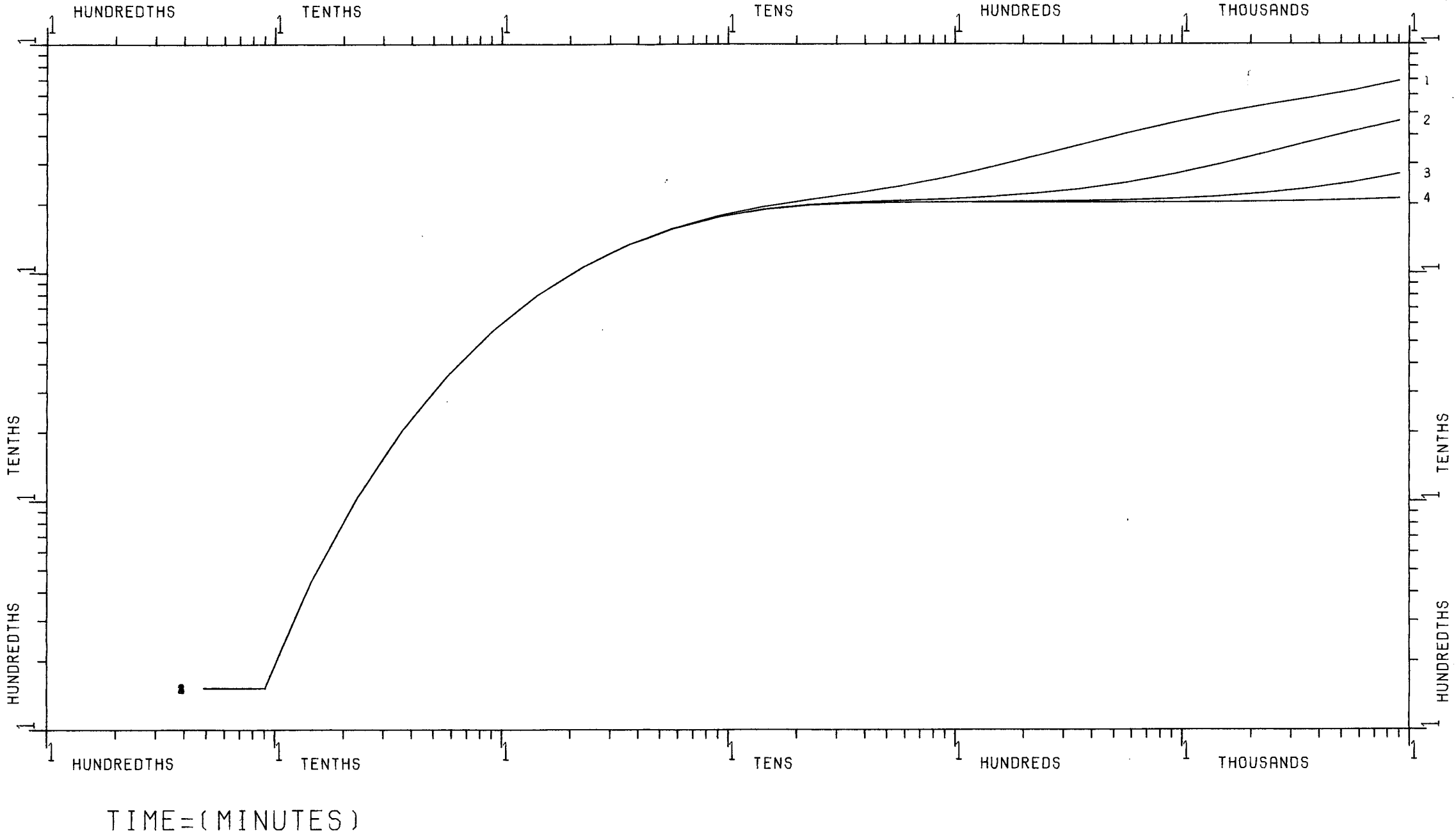
WMD

TAPENO 6230 PLOT NO 0036  
USER NO SHINE DATE 87/08/31

TIME 15:12

PROC NEUMAS RUN AT 14.16.09. 87/08/31.

DRAWDOWN I (FT)



WMD

TAPENO 6230  
USER NO SHINE

PLOT NO 0027

DATE 87/11/17

TIME 10:12

# ACME 18-1S

NEUMAN PARTIAL PENETRATION SOLUTION

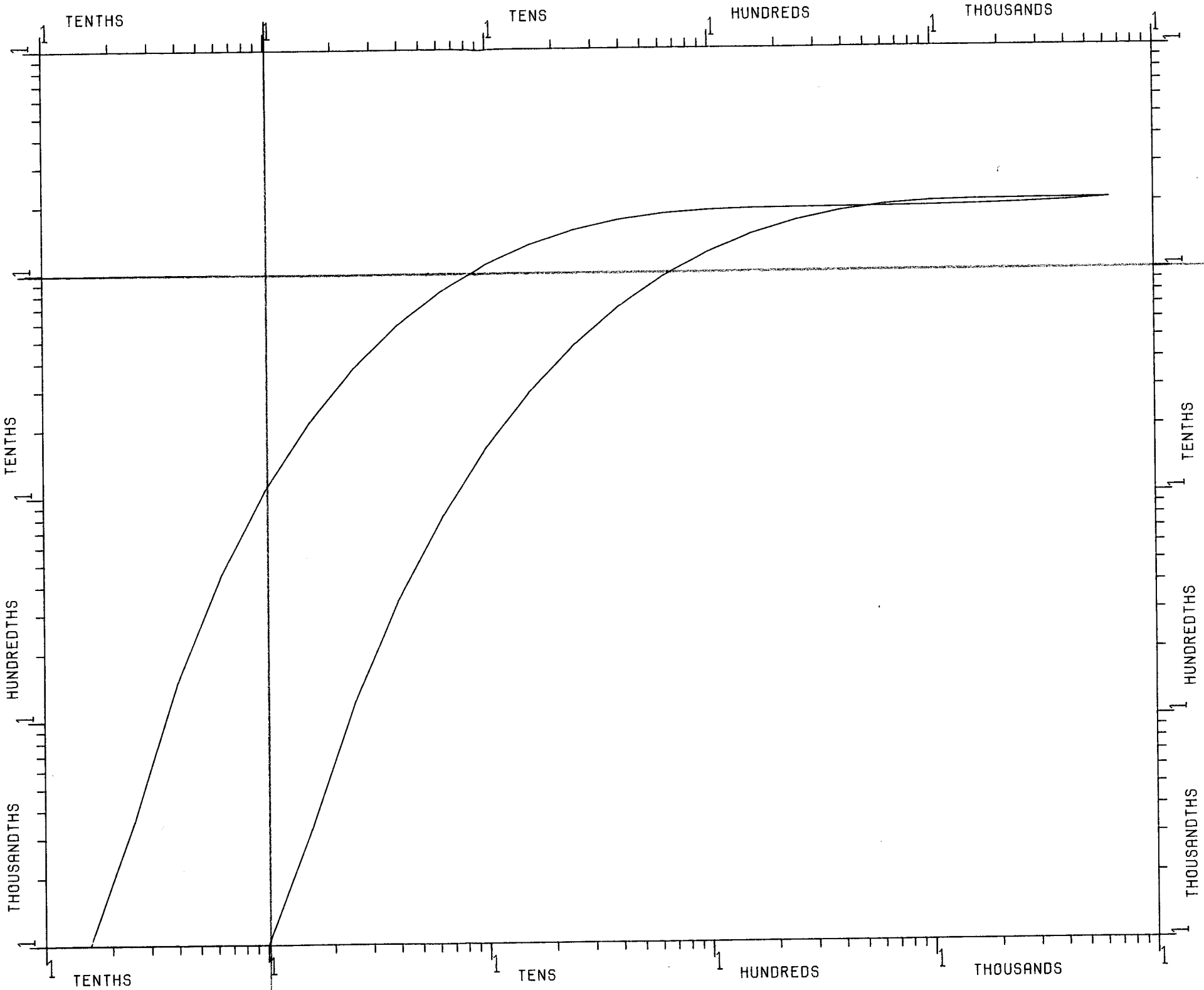
B: 111' PW TD/CD: 86'/66' OW TD/CD: 56'/6'

ZD1=.4955, ZD2=.9459, PD=.7748, DD=.5946

BETA = .0009, .009

PROC NEUMAN RUN AT 09.50.40. 87/11/17.

$S(D) = 4 * \pi * T * S * \frac{Q}{D} * \frac{1}{r} * \frac{1}{\sqrt{t}}$



$T(S) = \text{TRANSMISSIVITY} * \text{TIME} / \text{STORATIVITY} * \text{DISTANCE} ** 2$



WMD

TAPENO 6230 PLOT NO 0030  
USER NO SHINE

DATE 87/11/17 TIME 10:16

# ACME DEEP OBS WELLS

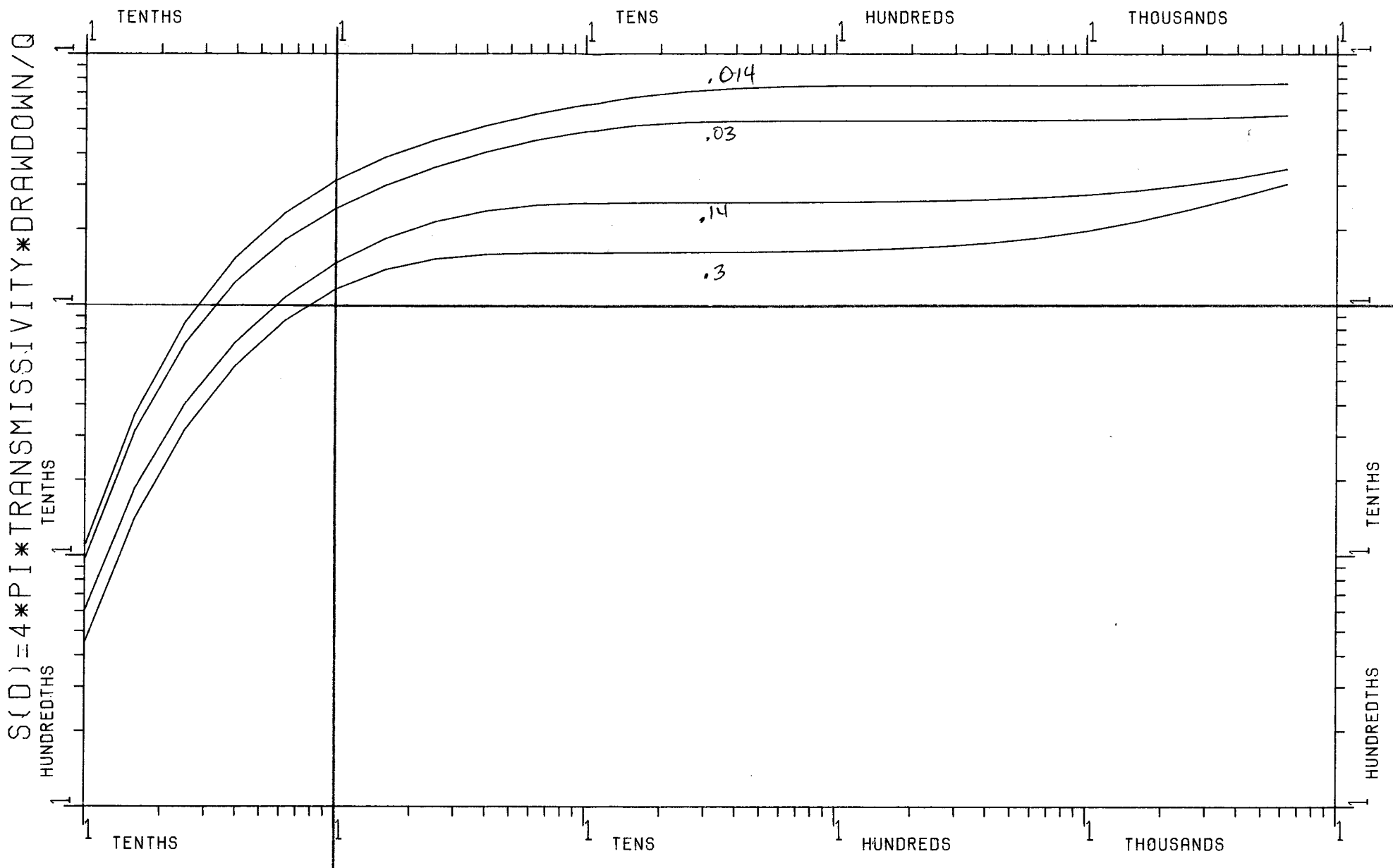
NEUMAN PARTIAL PENETRATION SOLUTION

B: 111' PW TD/CD: 86'/66' OW TD/CD: 86'/66'

ZD1=.2252, ZD2=.4054, PD=.7748, DD=.5946

BETA = .014, .03, .14, .3

PROC NEUMAN RUN AT 09.49.17. 87/11/17.



$$T(S) = \text{TRANSMISSIVITY} * \text{TIME} / \text{STORATIVITY} * \text{DISTANCE} ** 2$$

WMD

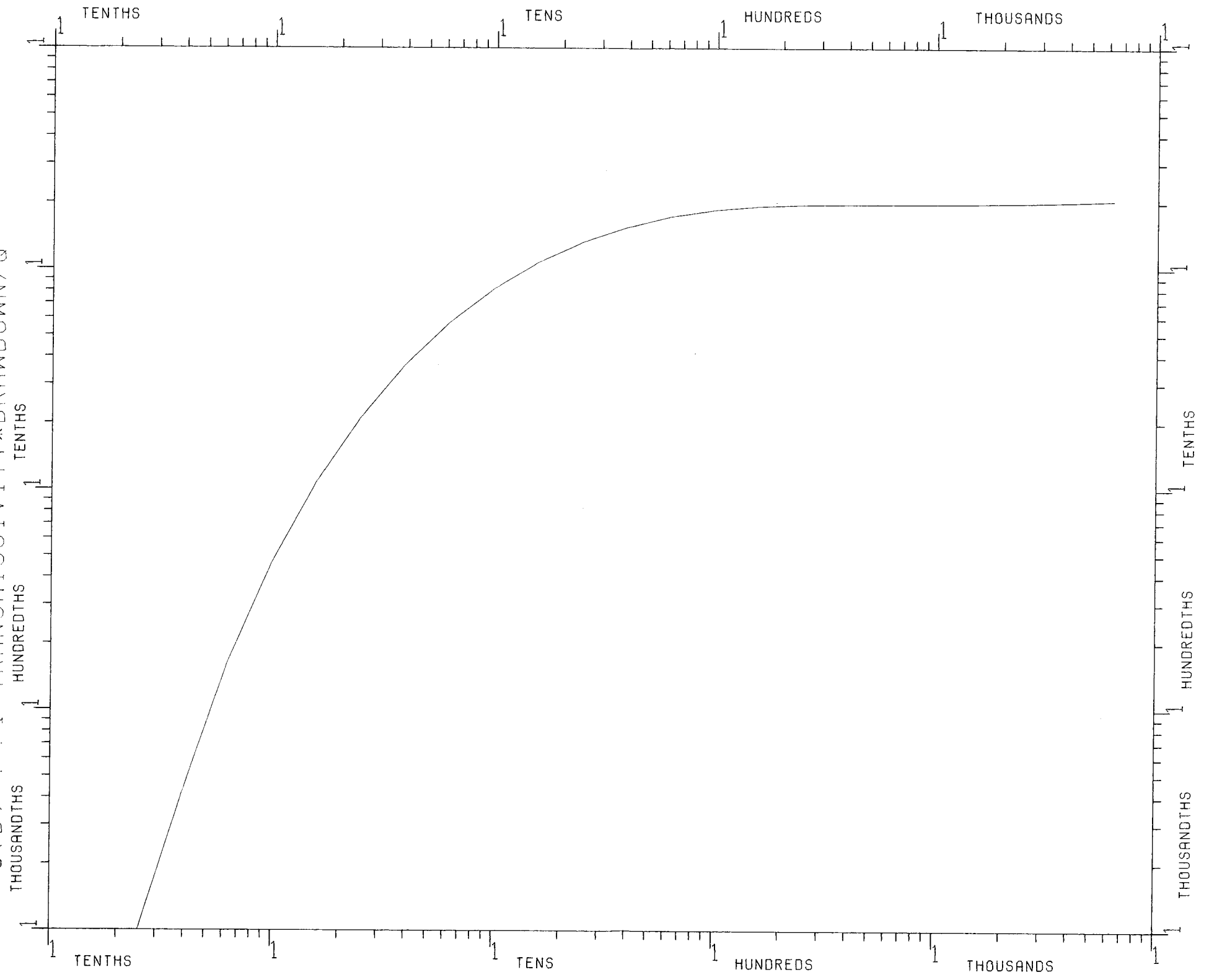
TAPENO 6355 PLOT NO 0132  
USER NO PALM3D DATE 87/06/11 TIME 17:08

# ACME OBS WELL 18-1S

NEUMAN PARTIAL PENETRATION SOLUTION  
B: 111' PW TD/CD: 86'/66' OW TD/CD: 56'/6'  
ZD1=.4955, ZD2=.9459, PD=.7748, DD=.5946  
BETA = .005

PROC NEUMAN RUN AT 16.56.41. 87/06/11.

$S(D) = 4 * P I * TRANSMISSIVITY * DRAWDOWN / Q$



$T(S) = TRANSMISSIVITY * TIME / STORATIVITY * DISTANCE ** 2$

WMD

TAPENO 6355 PLOT NO 0129  
USER NO PALM3D DATE 87/06/11

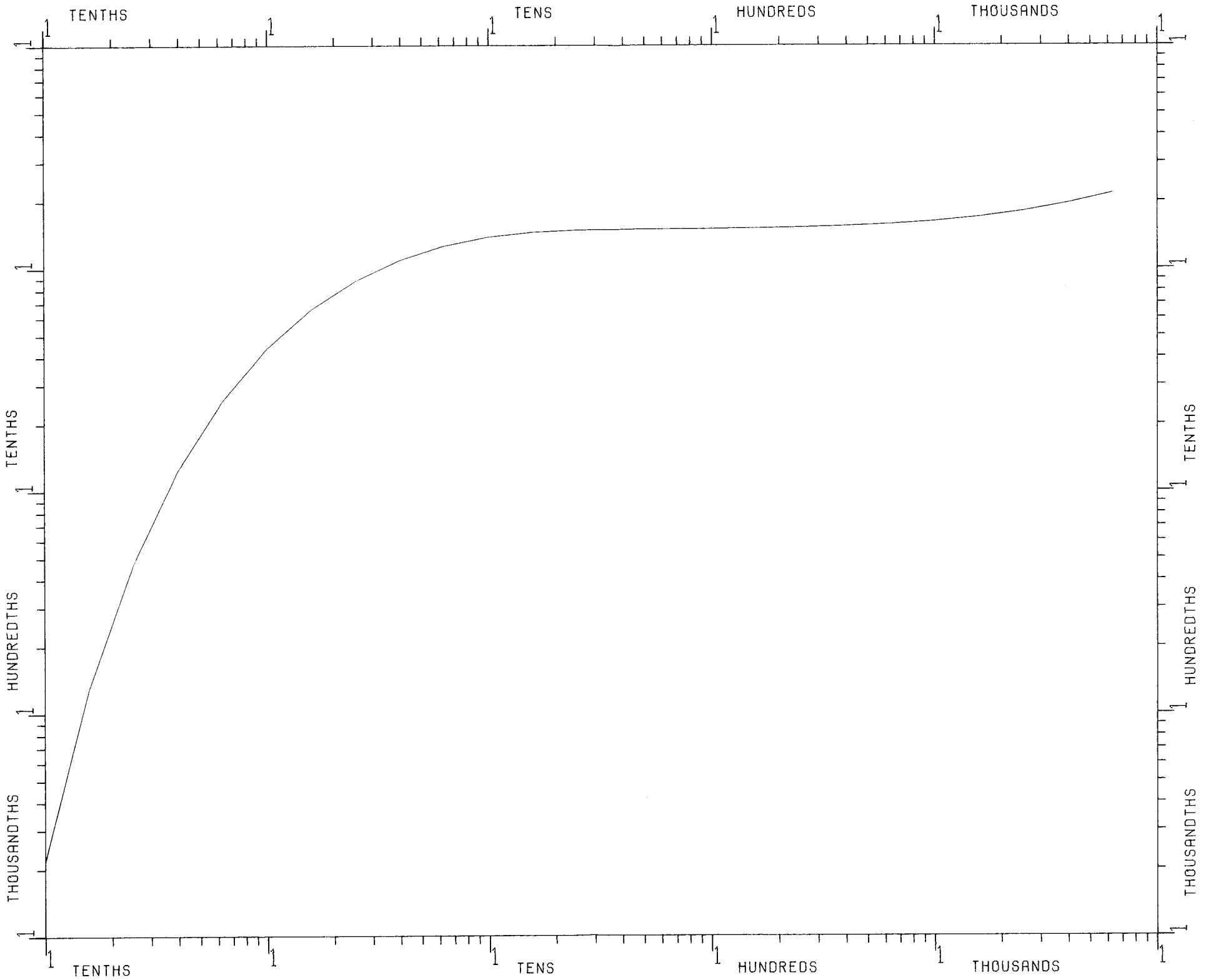
TIME 17:07

# ACME OBS WELL 18-1S

NEUMAN PARTIAL PENETRATION SOLUTION  
B: 111' PW TD/CD: 86'/66' OW TD/CD: 56'/6'  
ZD1=.4955, ZD2=.9459, PD=.7748, DD=.5946  
BETA = .05

PROC NEUMAN RUN AT 16.57.33. 87/06/11.

$S(D) = 4 * \pi * \text{TRANSMISSIVITY} * \text{DRAWDOWN} / Q$



$T(S) = \text{TRANSMISSIVITY} * \text{TIME} / \text{STORATIVITY} * \text{DISTANCE} ** 2$

WMD

TAPENO 6355 PLOT NO 0126  
USER NO PALM3D DATE 87/06/11

TIME 17:07

# ACME OBS WELL 18-1S

NEUMAN PARTIAL PENETRATION SOLUTION

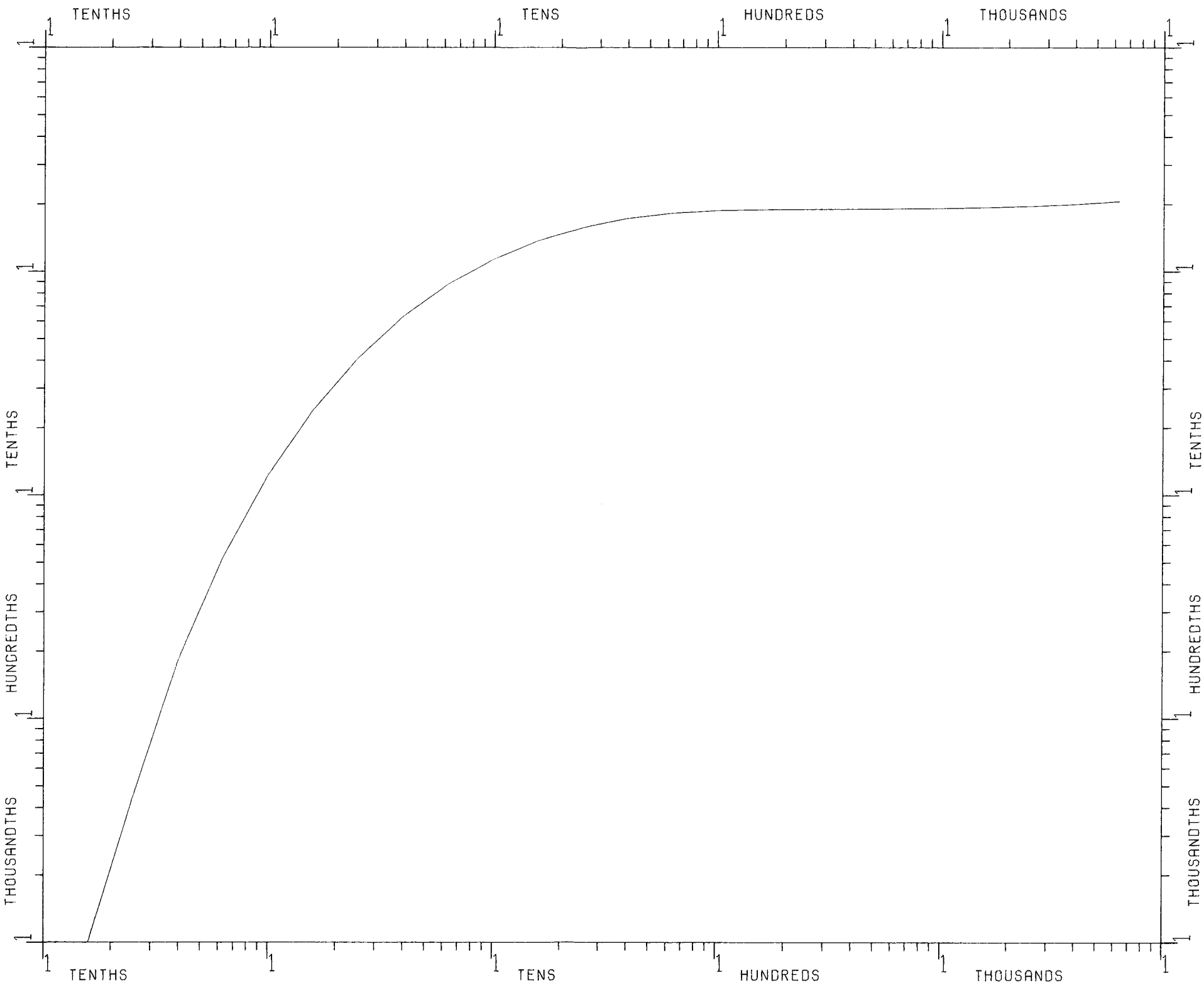
B: 111' PW TD/CD: 86'/66' OW TD/CD: 56'/6'

ZD1=.4955, ZD2=.9459, PD=.7748, DD=.5946

BETA = .01

PROC NEUMAN RUN AT 16.55.59. 87/06/11.

$S(D) = 4 * \pi * \text{TRANSMISSIVITY} * \text{DRAWDOWN} / Q$



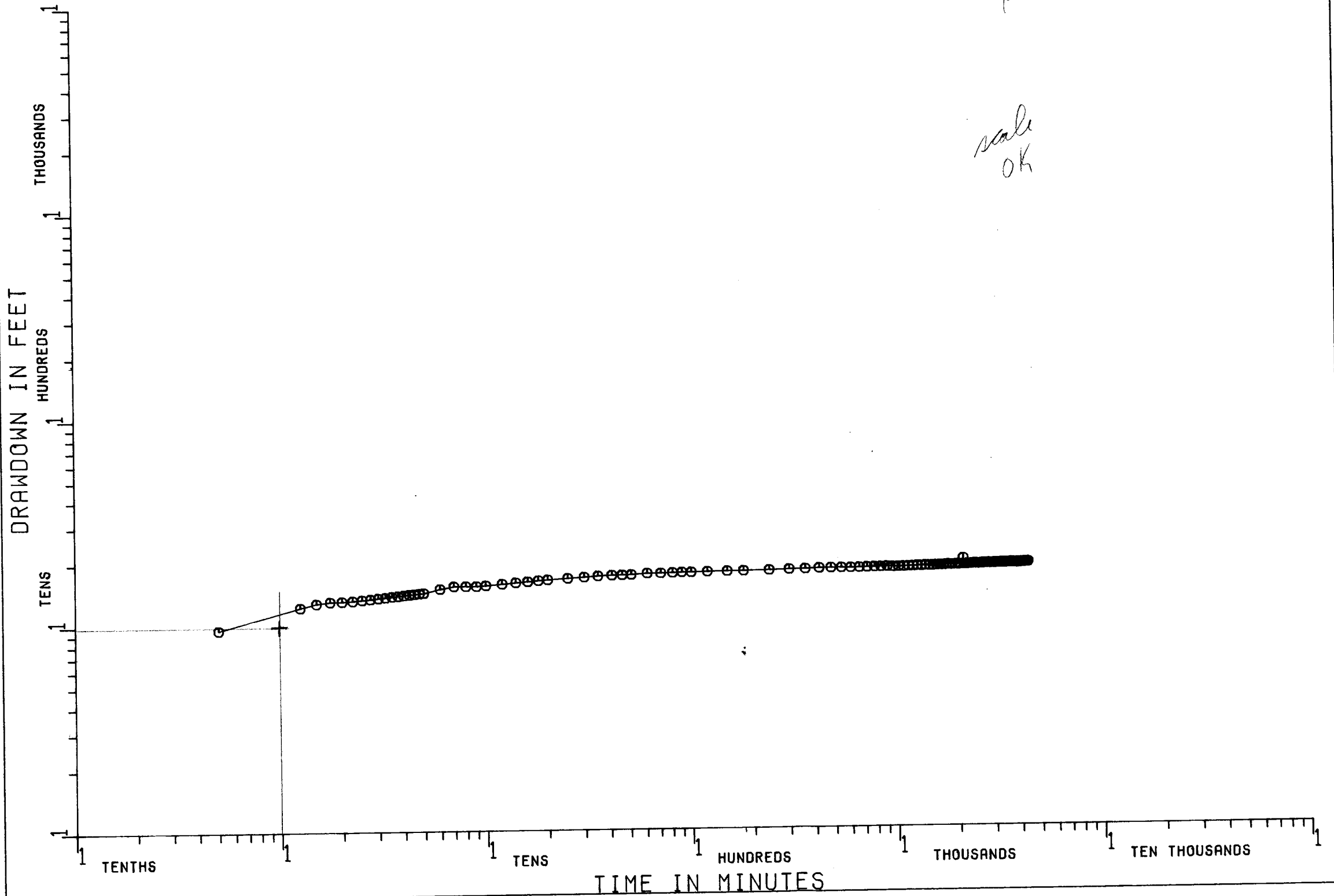
$T(S) = \text{TRANSMISSIVITY} * \text{TIME} / \text{STORATIVITY} * \text{DISTANCE} ** 2$

OBSERVATION WELL: WELL 18-1D

R= 33 ~~8~~ Q= 900

$\rho' = .1$

scale  
OK



ACME IMPROVEMENT DISTRICT

WMD

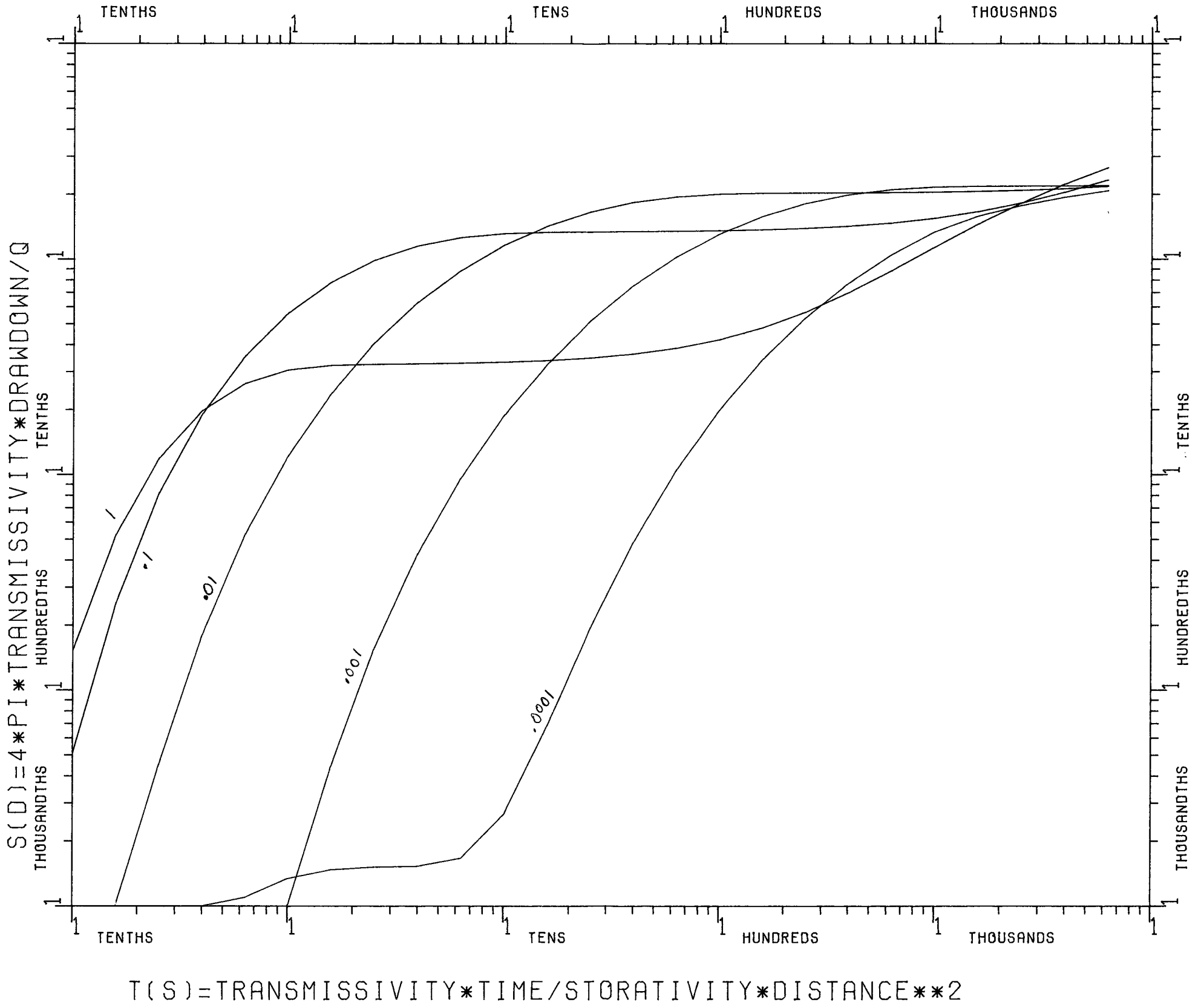
TAPENO 6230 PLOT NO 0004  
USER NO RBOWER DATE 87/06/10

TIME 16:35

# ACME OBS WEL 18-1S

NEUMAN PARTIAL PENETRATION SOLUTION  
B: 111' PW TD/CD: <sup>88</sup>90'/<sup>86</sup>70' OW TD/CD: <sup>56</sup>60'/<sup>6</sup>10'  
ZD1=.4595, ZD2=.9099, PD=.8108, DD=.6306  
BETA = .0001, .001, .01, .1, 1

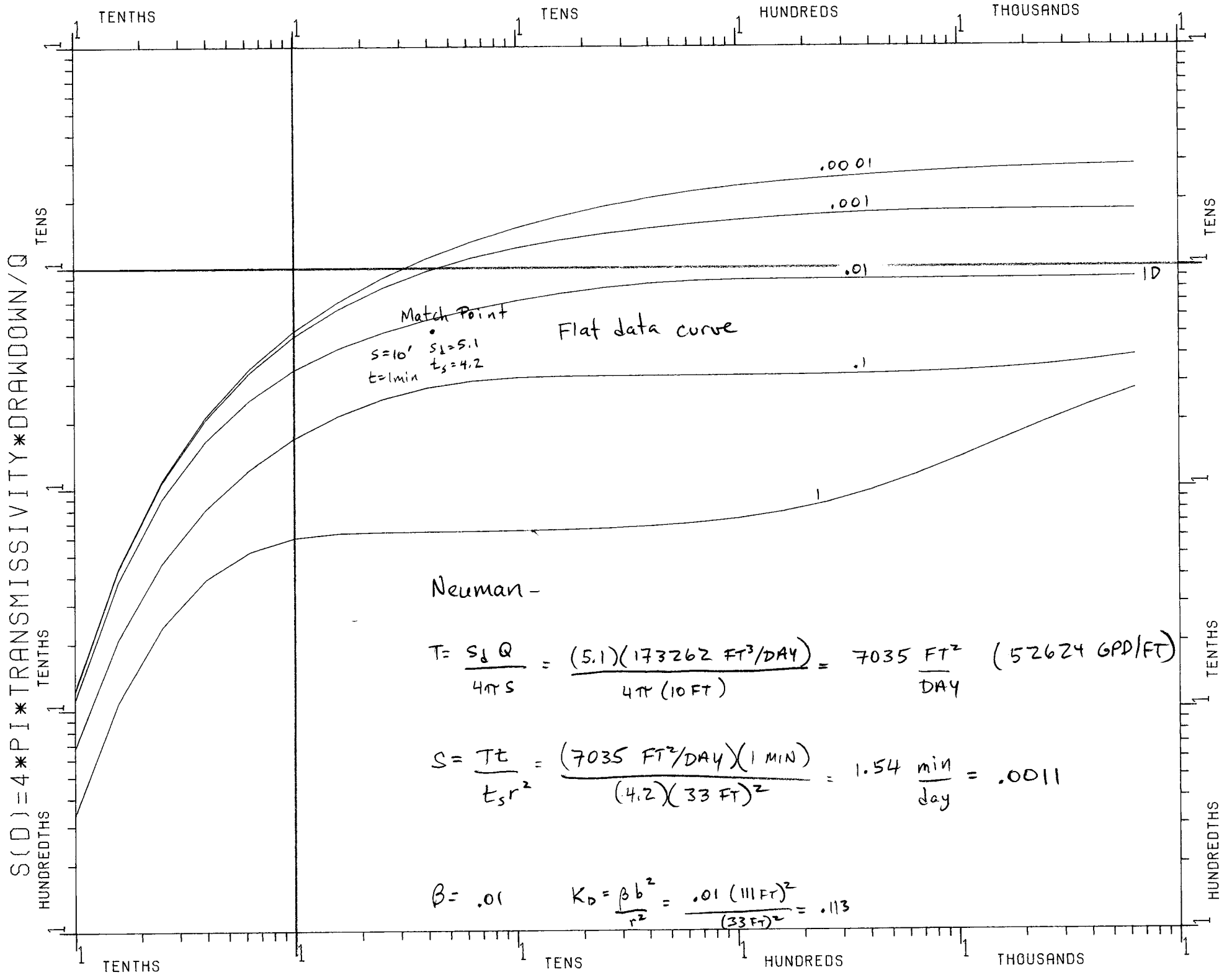
PROC NEUMAN RUN AT 15.00.03. 87/06/10.



# ACME OBS WELL 1D

NEUMAN PARTIAL PENETRATION SOLUTION  
 B: 111' PW TD/CD: 90'/70' OW TD/CD: 90'/70'  
 ZD1=.1892, ZD2=.3694, PD=.8108, DD=.6306  
 BETA = .0001, .001, .01, .1, 1

PROC NEUMAN RUN AT 15.10.20. 87/06/10.



Neuman -

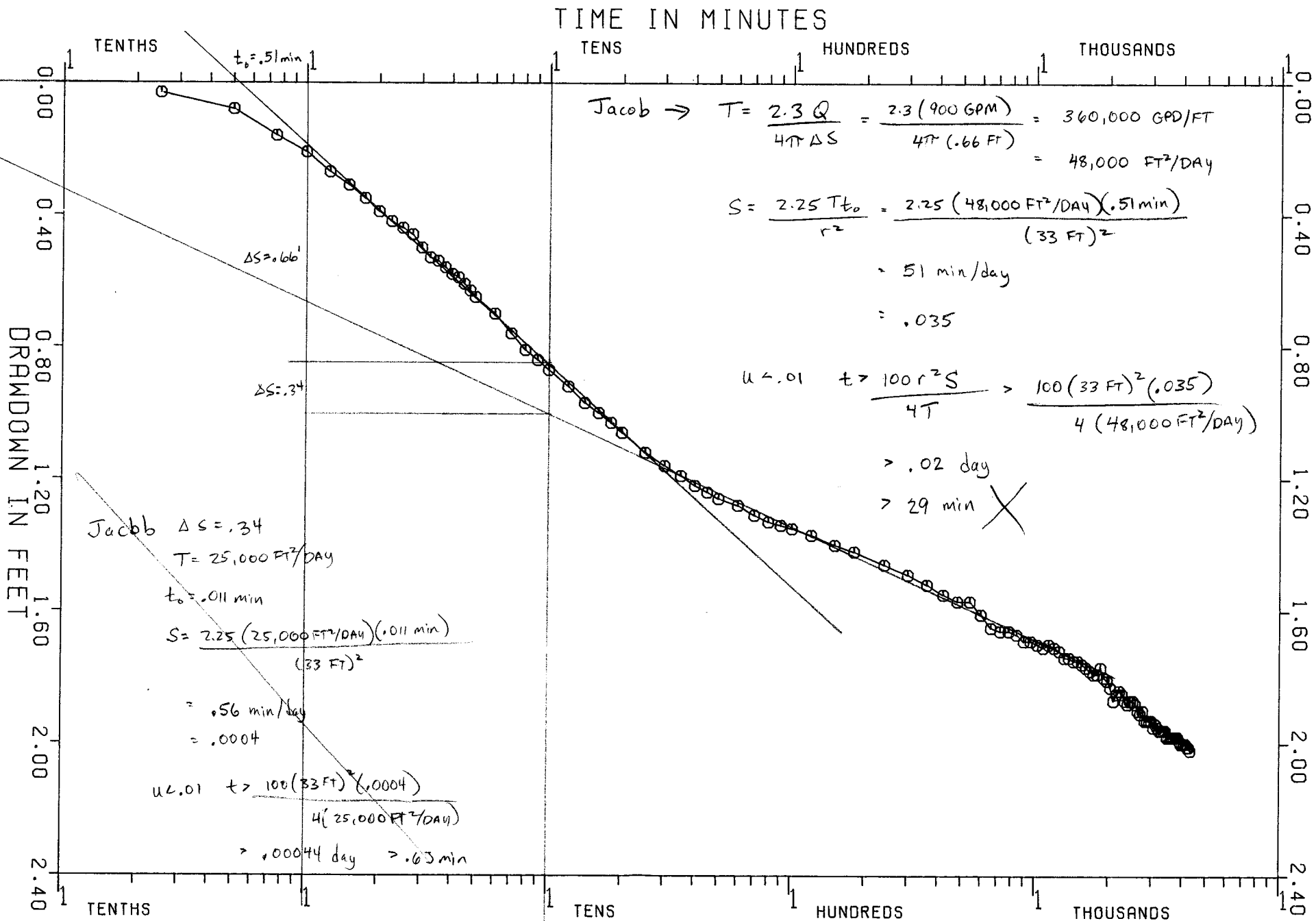
$$T = \frac{S_b Q}{4\pi S} = \frac{(5.1)(173262 \text{ FT}^3/\text{DAY})}{4\pi (10 \text{ FT})} = 7035 \frac{\text{FT}^2}{\text{DAY}} \quad (52624 \text{ GPD/FT})$$

$$S = \frac{Tt}{t_s r^2} = \frac{(7035 \text{ FT}^2/\text{DAY})(1 \text{ MIN})}{(4.2)(33 \text{ FT})^2} = 1.54 \frac{\text{min}}{\text{day}} = .0011$$

$$\beta = .01 \quad K_D = \frac{\beta b^2}{r^2} = \frac{.01 (111 \text{ FT})^2}{(33 \text{ FT})^2} = .113$$

T(S) = TRANSMISSIVITY \* TIME / STORATIVITY \* DISTANCE \*\* 2

ACME IMPROVEMENT TIME DRAWDOWN  
 OBSERVATION WELL: WELL 18-1S  
 R= 33 Q= 900



TIME 09:25

DATE 87/07/31

PLOT NO 0035

USER NO SHINE

MMD

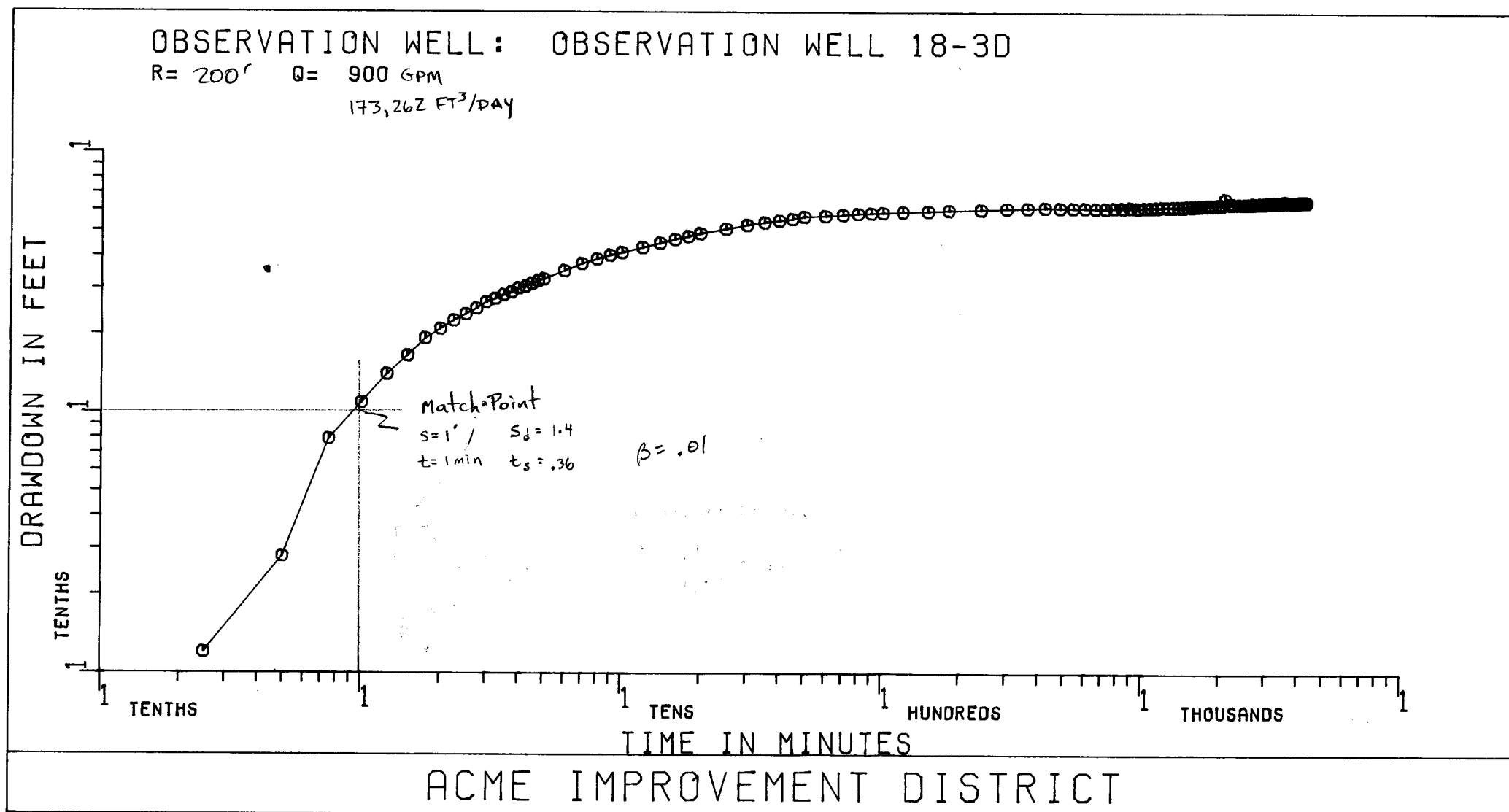


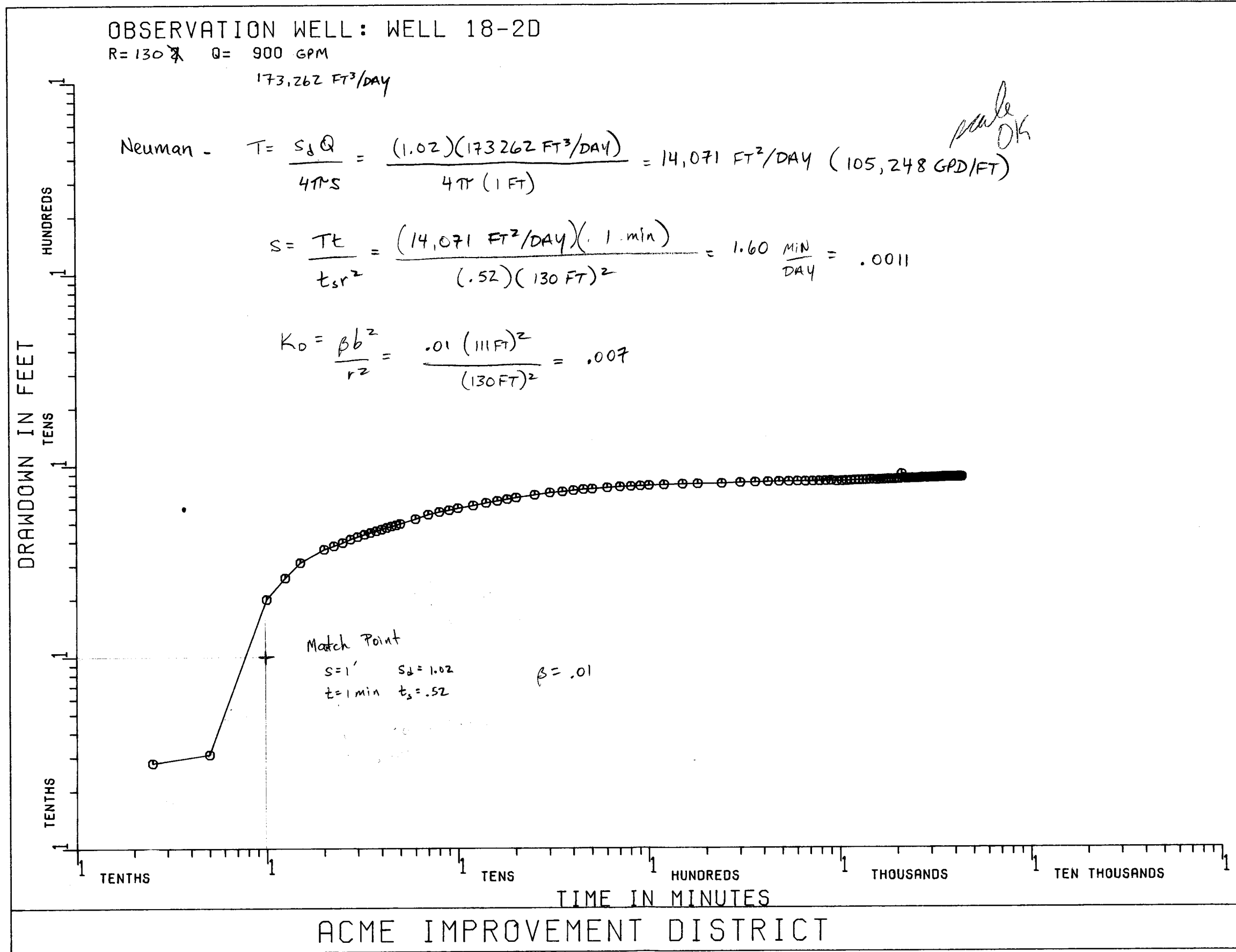
WMD TAPEN0 6265 PLOT NO 0412 DATE 86/05/05 TIME 12:57  
 USER NO NELMS

Neuman -  $T = \frac{S_d Q}{4\pi s} = \frac{1.4 (173262 \text{ FT}^3/\text{DAY})}{4\pi (1 \text{ FT})} = 19,313 \text{ FT}^2/\text{DAY} \quad (144,459 \text{ GPD/FT})$

$S = \frac{Tt}{t_s r^2} = \frac{(19313 \text{ FT}^2/\text{DAY})(1 \text{ min})}{.36 (200 \text{ FT})^2} = 1.341 \frac{\text{MIN}}{\text{DAY}} = .00093$

$K_D = \frac{\beta b^2}{r^2} = \frac{.01 (111 \text{ FT})^2}{(200 \text{ FT})^2} = .003$





WMD

TAPENO 6350  
USER NO SHINE

PLOT NO 0009

DATE 87/05/20

TIME 09:24

