SITE 5

AQUIFER-TEST REPORT

I. SUMMARY

A. Location Palm Beach County, Florida

B. Date February 17, 1987

C. Well Development 2 hours with air; 2 hours of pumping

D. Length of Test 360 minutes of pumping

E. Discharge 335 gallons per minute

F. Hydraulic Coefficients Transmissivity is 19,700 square feet per day from observation well data.

G. Analytical Model Cooper-Jacob straight line

H. Preparer Leo J. Swayze

I. Reviewer Subdistrict Ground Water Specialist

J. Remarks The transmissivity represents the section of the aquifer between 57 and 180 feet below land surface.

II. NARRATIVE

A. Introduction

1. Test purpose To provide water managers with hydraulic parameters for ground-water modeling.

2. Personnel The test was conducted by personnel (Richard Kane and Jeff Christian) of the U.S. Geological Survey, Water Resources Division, Miami subdistrict.

B. Physical Conditions

1. Aquifer description The main water-bearing zone of the surficial aquifer consists primarily of about 123 feet of sandy limestones interbedded with unconsolidated layers of sand and shell. This is overlain by about 57 feet of a moderately sorted, fine sand and shelly marl of comparatively lower permeability. The overlying sands and shelly marls act as a confining layer for short periods of pumping. On a long-term pumping basis, the aquifer should be considered as "water table." The base of the surficial aquifer is 360 feet below land surface.

2. Site location The test site is located in eastern Palm Beach County, Florida, west of Boynton Beach (see map).

Latitude is 26°32'16" Longitude is 80°06'17"

3. Well descriptions A geologic test well (PB-1603) was drilled to the base of the aquifer. The section to be tested was then determined by field observation of drill cuttings. The borehole was then backfilled to 170 feet. An observation well was established by screening the interval between 60 and 170 feet. A 9-inch borehole was drilled 30 feet from the observation well. A pumping well (PB-1604) was created by installing 6-inch PVC casing and screening the interval between 60 and 170 feet with 6-inch 60 slot PVC screen (see enclosed construction schedule).

4. Pump The well was pumped with a 40-horsepower 4-inch Rupp self-priming centrifugal pump.

5. Drawdown measurements Measurements were made with a chalked tape in both the pumping and observation wells.

6. Discharge Discharge was measured using the "free discharge pipe oriface" method as described in the Bureau of Reclamation's Ground Water Manual. A 10-foot length of 12-inch diameter PVC pipe fitted with a 6-inch PVC pipe riser was used to vent H_2S gas before discharge through the oriface was measured. Discharge was 335 gallons per minute.

7. Computations Computations are shown on the semilog graph of drawdown versus time. Method of analysis is based on the Cooper-Jacob straight line method as described by Lohman (1972) and Kruseman and DeRidder (1976).

C. Results

1. A reasonable comparison existed between transmissivity calculated from pumping well drawdown data, 19,900 square feet per day, and observation well drawdown data, 19,700 square feet per day. Drawdown data from the pumping well show some scatter. This was probably due to small fluctuation in the pumping rate, and surging caused by hydrogen sulfide gas release from the pumped ground water in the stand pipe. Interference from nearby irrigation wells caused the time-drawdown graph to deviate from the theoretical curve toward the end of the test. Grain-size analysis of the sands yielded a horizontal permeability value of 24 feet per day (Lappala, 1978). Vertical permeabilities could be 2 to 10 times lower (Weeks, 1976). This is about 67 times less than the horizontal permeability of the tested zone (160 feet per day). Based on this physical model of the system, aquifer characteristics were calculated using the Cooper-Jacob straight line method applied to the early drawdown data.

2. Transmissivity Aquifer transmissivity is about 19,700 square feet per day for geologic materials between 37 and 180 feet.

3. Storage coefficient Not applicable

4. Other activities in the area None

5. References

Kruseman, G.P., and DeRidder, N.A., 1976, Analysis and evaluation of pumping test data: International Institute for Land Reclamation and Improvement/ILRI, Wageningen, The Netherlands, 200 p.

Lappala, E.G., 1978, Quantitative hydrogeology of the Upper Republican Natural Resource District, southwest Nebraska: U.S. Geological Survey Water-Resources Investigations Report 78-38, 200 p.

Lohman, S.W., 1972, Ground-water hydraulics: U.S. Geological Survey Professional Paper 708, 70 p.

Weeks, E.P., 1978, Aquifer tests - the state of the art in hydrology: Invitational well-testing symposium proceedings, Lawrence-Berkley Report LBC-7027, Lawrence-Berkley Laboratory, University of California, 26 p.

D. Figures

1. Map of Palm Beach County with site location.

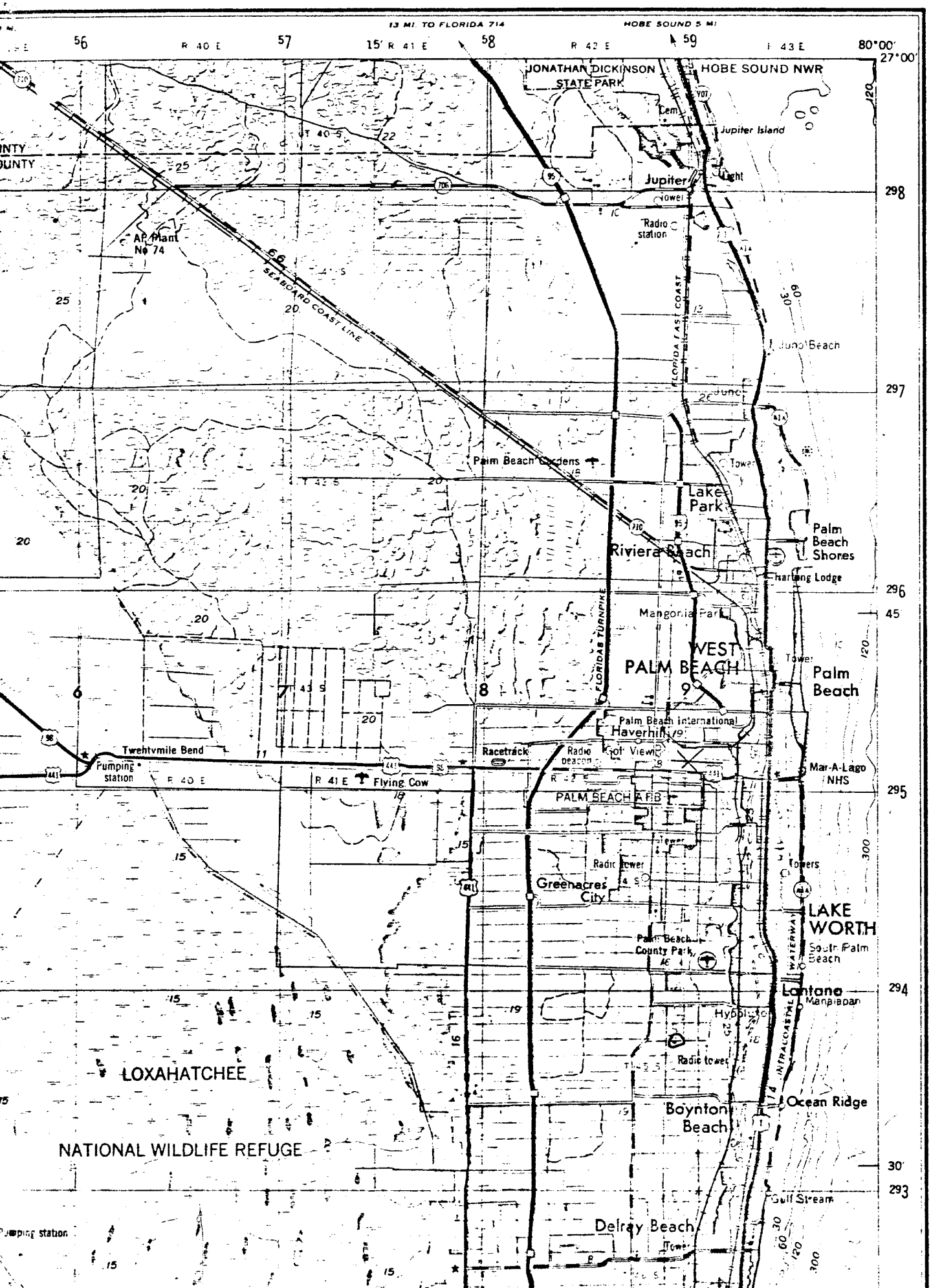
2. Calculations

   Semilog graph of time versus drawdown for pumping well and observation well.

3. Generalized geologic column.

4. Drawing of well construction.

Tables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HOBE SOUND 5 MI
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R 40 E
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15' R 41 E
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R 42 E
59
R 43 E
80°00'
27°00'
JONATHAN DICKINSON STATE PARK
HOBE SOUND NWR
Jupiter Island
Jupiter
Light
Tower
Radio station
AP Plant No 74
SEABOARD COAST LINE
FLORIDA EAST COAST
Juno Beach
Palm Beach Gardens
Lake Park
Riviera Beach
Palm Beach Shores
Mangonia Park
WEST PALM BEACH
Palm Beach
Palm Beach International
Haverhill
Twelvemile Bend
Pumping station
Racetrack
Radio beacon
Golf Viewing
Mar-A-Lago NHS
Flying Cow
PALM BEACH A F B
Radio Tower
Towers
Greenacres City
LAKE WORTH
South Palm Beach
Palm Beach County Park
Lantana
Manalapan
Hypoluxo
Radio tower
Ocean Ridge
Boynton Beach
LOXAHATCHEE
NATIONAL WILDLIFE REFUGE
Gulf Stream
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Pumping station
INTRACOASTAL WATERWAY
FLORIDA'S TURNPIKE
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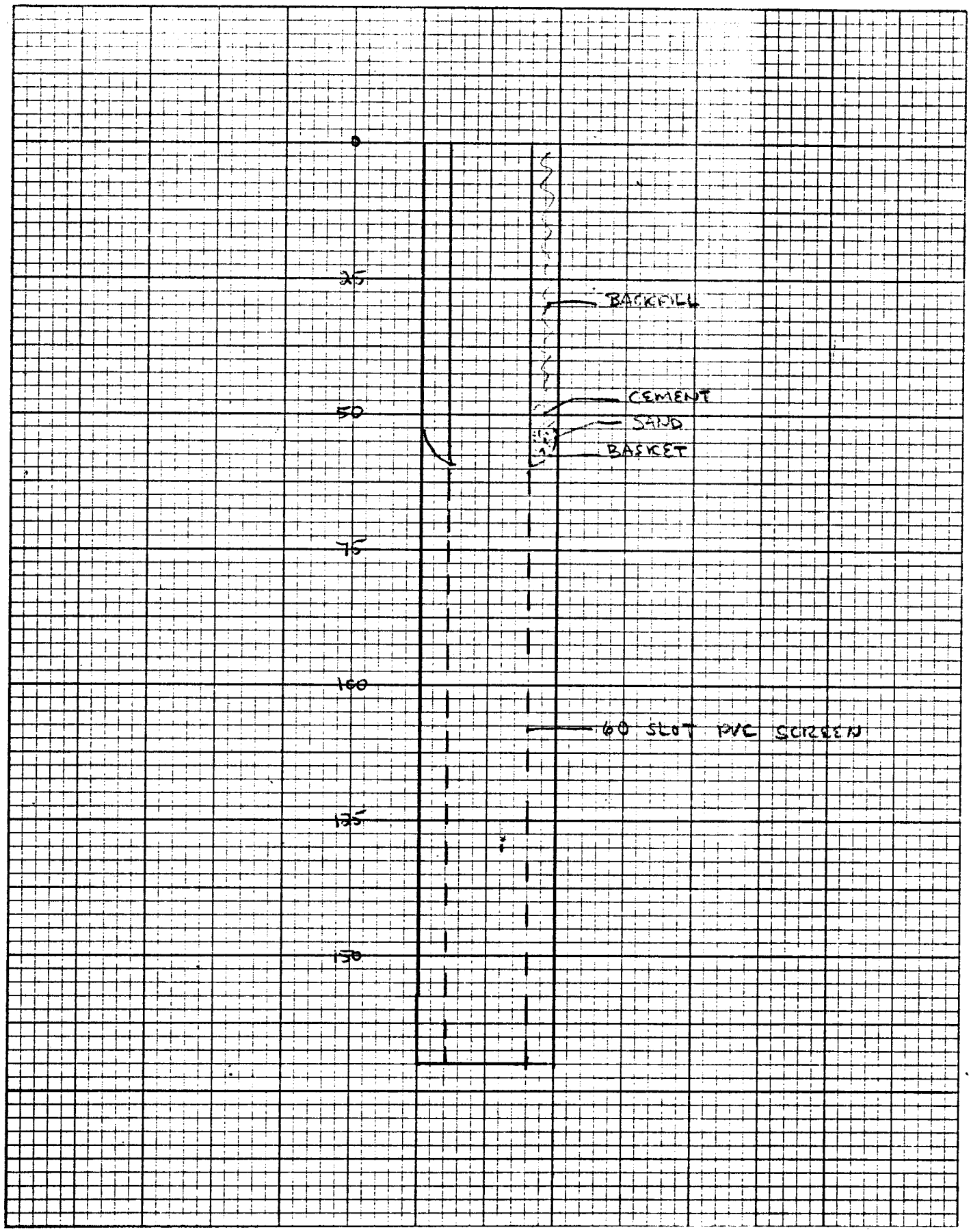


Well Construction: A 9-inch hole was drilled to 170 feet. A 6-inch PVC casing was then lowered to the bottom of the hole inside the 9-inch steel casing. The steel casing was then pulled back to 60 feet which allowed the basket to open. The open hole was then sand packed and cemented. The rest of the 9-inch steel casing was then removed. The open hole was then back-filled with sand and cuttings.

TIME	DTW	DISCHARGE	RADIUS
0.000	5.520	52167	3
2.250	5.660		
3.000	5.680		
4.000	5.740		
5.000	5.820		
6.000	5.840		
7.000	5.880		
8.000	5.920		
9.000	5.960		
10.000	6.000		
11.000	6.040		
13.000	6.040		
15.000	6.080		
17.000	6.080		
19.000	6.080		
21.000	6.090		
23.000	6.130		
25.000	6.120		
27.000	6.160		
29.000	6.150		
31.000	6.170		
32.000	6.130		

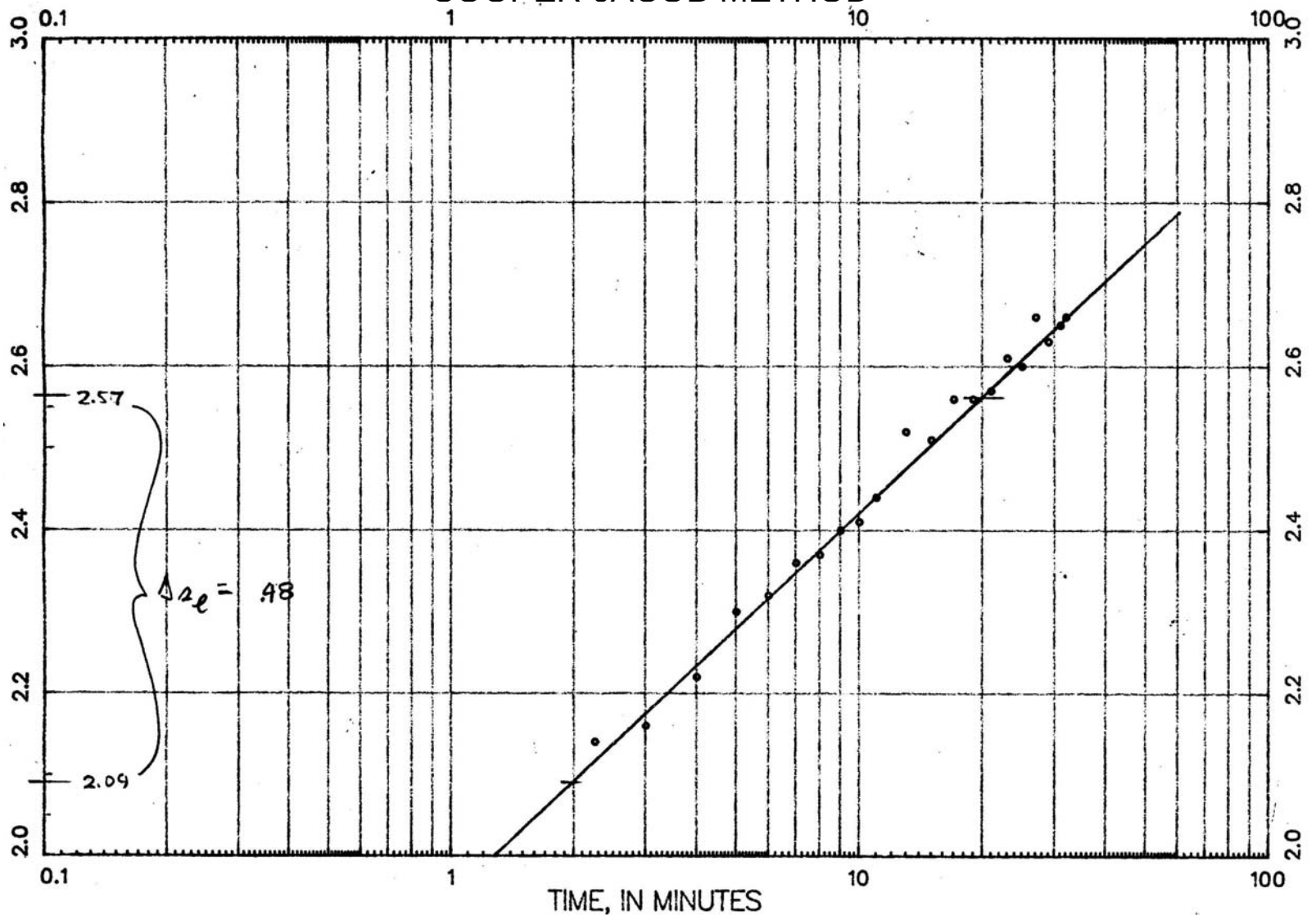
$T = KD = (2.3)(Q) / (4)(\pi)(\Delta s_\ell)$

$= (2.3)(52167) / (4\pi)(.48)$

$= 19901 \text{ ft}^2/\text{d}$

DRAWDOWN VS. TIME

COOPER-JACOB METHOD



GSPT5 Dan'

TIME	DTW	DISCHARGE	RADIUS
0.000	5.120	64437 FT3/DAY	30
2.000	6.240	"	
3.0000	6.3300	335 GPM	
4.0000	6.4000		
5.0000	6.4500		
6.0000	6.4900		
7.0000	6.5400		
8.0000	6.5600		
9.0000	6.6000		
10.0000	6.6200		
11.0000	6.6500		
12.0000	6.6700		
13.0000	6.7000		
14.0000	6.7200		
15.0000	6.7400		
17.0000	6.7800		
19.0000	6.8100		
21.0000	6.8400		
23.0000	6.8600		
25.0000	6.8800		
27.0000	6.9000		
29.0000	6.9100		
35.0000	6.9600		
40.0000	6.9900		
45.0000	7.0200		
50.0000	7.0400		
55.0000	7.0600		
60.0000	7.0900		
75.0000	7.1300		
90.0000	7.1300		
105.0000	7.1400		
120.0000	7.1500		
135.0000	7.1600		
150.0000	7.1500		
165.0000	7.0900		
180.0000	7.0900		
195.0000	7.1100		
210.0000	7.1400		
225.0000	7.2800		
240.0000	7.3700		
255.0000	7.4200		
270.0000	7.4300		
285.0000	7.4200		
300.0000	7.4500		
315.0000	7.4700		
330.0000	7.4200		
345.0000	7.2800		
360.0000	7.2000		

PB-1

PB-1

TIME	DTW	DISCHARGE	RADIUS
0.000	5.120	64487	30
2.0000	6.240		
3.0000	6.330		
4.0000	6.400		
5.0000	6.450		
6.0000	6.490		
7.5000	6.540		
9.0000	6.590		
10.000	6.620		
11.000	6.650		
12.000	6.670		
13.000	6.700		
14.000	6.720		
15.000	6.740		
17.000	6.770		
19.000	6.810		
21.000	6.840		
23.000	6.870		
25.000	6.900		
27.000	6.910		
30.000	6.940		
35.000	6.980		
40.000	7.020		
45.000	7.060		
50.000	7.090		
55.000	7.110		
60.000	7.130		
75.000	7.160		
90.000	7.180		
105.000	7.200		
120.000	7.220		
135.000	7.230		
150.000	7.250		
165.000	7.260		
180.000	7.270		
195.000	7.280		
210.000	7.290		
225.000	7.300		
240.000	7.310		
255.000	7.320		
270.000	7.330		
285.000	7.340		
300.000	7.350		
315.000	7.360		
330.000	7.370		
345.000	7.380		
360.000	7.390		

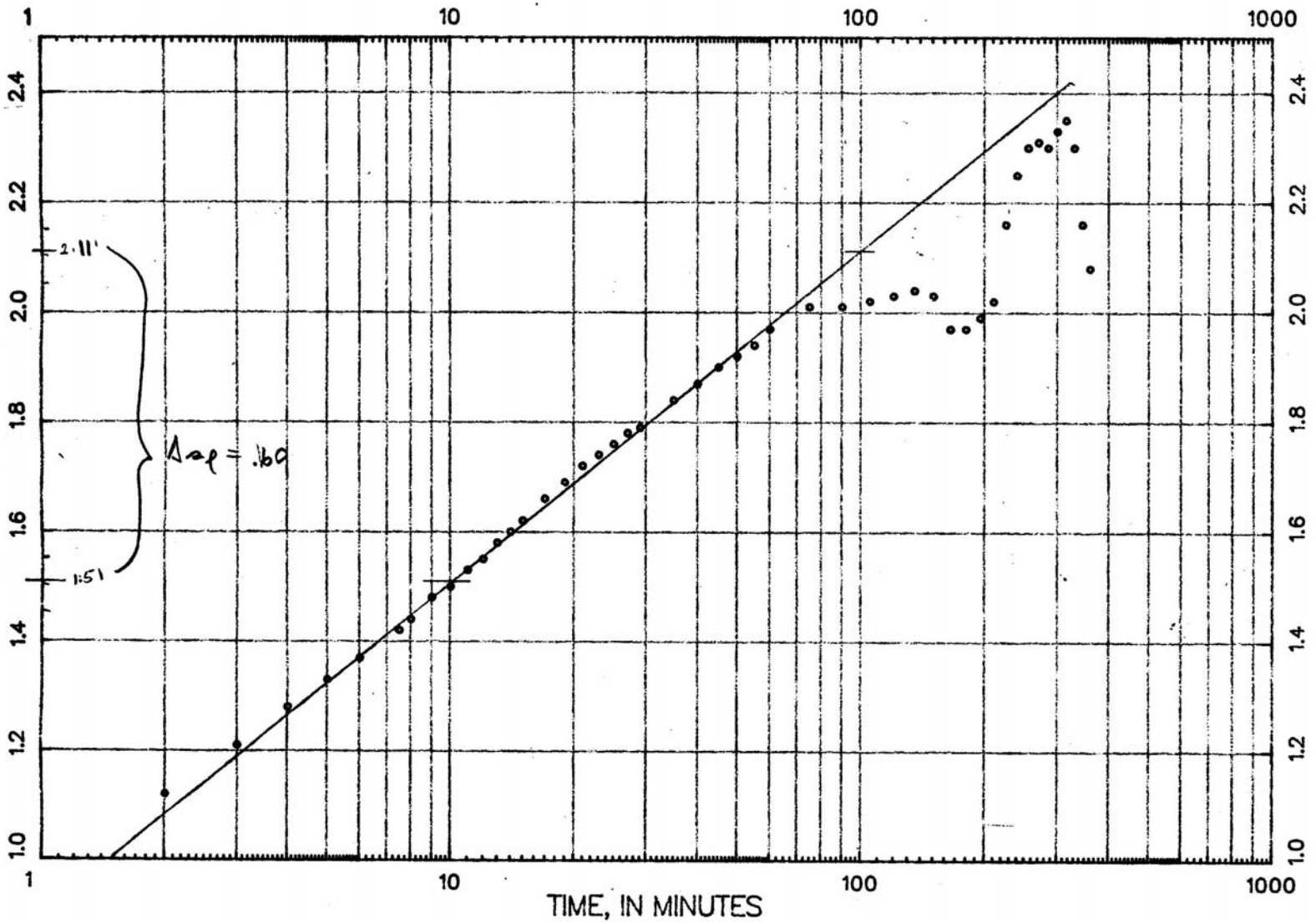
$K_D = (2.3)(Q)/4\pi(\Delta s')$

$K_D = (2.3)(6448)/4\pi(.60)$

$= 19,681$

DRAWDOWN VS. TIME

COOPER-JACOB METHOD



Lithologic Log of Well PB-1603

Lat 26°32'15", long 80°06'17"
Sec. 18, T. 45 S., R. 43 E.

Description	Thickness (feet)	Depth, feet below land surface
Muddy sand, dark-yellowish-brown (10 Y 4/2); quartzose, medium to fine, moderately to well sorted, angular to subangular; 30 to 40 percent organic debris and mud; 1 percent heavy minerals, fine, subangular to subrounded.	4	0 - 4
Muddy sand, dark-yellowish-brown (10 Y 4/2); quartzose, coarse to fine, moderately to well sorted, angular to subrounded; 20 to 30 percent mud; 1 percent heavy minerals as above.	3	4 - 7
Muddy sand, pale-yellowish-brown (10 YR 6/2) to dark-yellowish-brown (10 Y 4/2); quartzose as above; 1 to 3 percent heavy minerals as above; 20 to 30 percent mud, silt and clay size.	3	7 - 10
Muddy sand, pinkish-gray (5 YR 8/1) to pale-yellowish-brown (10 YR 6/2); quartzose as above; 3 to 5 percent heavy minerals, fine to very fine, subangular to subrounded; 10 to 20 percent mud.	4	10 - 14
Sand, pinkish-gray (5 YR 8/1); quartzose, coarse to fine, well sorted, angular to subrounded; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; 5 to 10 percent mud.	3	14 - 17
Muddy sand, moderate-brown (5 YR 3/4); quartzose as above; 3 percent heavy minerals as above; 30 percent mud, silt and clay size.	3	17 - 20
Muddy sand as above.	4	20 - 24
Muddy sand as above; 30 to 40 percent mud, silt and clay size.	3	24 - 27
Muddy sand, dark-yellowish-brown (10 YR 4/2).	3	27 - 30
Muddy sand as above.	4	30 - 34
Muddy sand, dusky-brown (5 YR 2/2); as above; 5 percent heavy minerals, medium to very fine, subangular to rounded; 40 percent mud, silt and clay size.	3	34 - 37

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Muddy sand, dusky-yellowish-brown (10 YR 4/2); as above.	3	37 - 40
Muddy sand, dark-yellowish-brown (10 YR 4/2); quartzose, coarse to very fine, well sorted, angular to subrounded; 5 to 10 percent heavy minerals, medium to very fine, subangular to rounded; 20 percent mud.	4	40 - 44
Muddy sand, dark-yellowish-brown (10 YR 4/2); quartzose as above; 5 to 10 percent heavy minerals as above; about 3 percent detrital carbonates; interbedded with about 5 percent sandstone nodules, medium-light-gravy (N 6); quartz, medium to fine, angular to subangular; 5 to 10 percent heavy minerals, medium to fine, subangular to rounded; sparite matrix; very porous; loosely cemented.	3	44 - 47
Limestone, light-gray (N 7) changes to olive-gray when wet with water; sandy, sparse biosparite; 40 percent quartz, coarse to fine, angular to subrounded; 5 to 10 percent heavy minerals as above; moderately cemented to gravel size; moderately porous; grades into sandstone gravel in places; interbedded with about 40 percent sand, pinkish-gray (5 YR 8/1) to light-olive-gray (5 Y 6/1); quartzose, medium to very fine, angular to subangular; 5 to 10 percent heavy minerals as above; about 5 to 10 percent silt; 5 to 10 percent detrital carbonates.	3	47 - 50
Limestone, medium-light-gray (N 6); sandy, sparse biosparite; as above with sandstone gravel; interbedded with about 40 percent sand; quartz as above; 5 to 10 percent heavy minerals as above; 5 to 10 percent detrital carbonates.	4	50 - 54
Limestone gravel, medium-light-gray (N 6) to light-olive-gray (5 Y 6/1); sandy, sparse biosparite, oyster shells; 30 to 40 percent quartz, medium to fine, angular to subangular; 5 to 10 percent heavy minerals, medium to very fine, subangular to rounded; loosely cemented; good porosity; interbedded with about 40 to 50 percent sand as above; 10 to 20 percent detrital carbonates and shell pieces.	3	54 - 57

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Sandy shell and gravel, yellowish-gray (5 Y 8/1); broken shell pieces and calcite; 30 to 40 percent quartzose as above; 5 to 10 percent heavy minerals as above; interbedded with about 10 percent limestone gravel; packed biosparite; 20 percent quartz as above; 3 percent heavy minerals as above; very porous; loosely cemented.	3	57 - 60
Limestone, yellowish-gray (5 Y 8/1) to light-gray (N 7); packed biosparite; 10 to 20 percent quartz as above; 5 percent heavy minerals as above; moderately to loosely cemeneted; good porosity; interbedded with about 40 percent shelly sand; quartzose, coarse to fine, well sorted, angular to subangular; 5 to 10 percent heavy minerals and phosphates, coarse to fine, subangular to rounded; about 30 percent shell pieces and calcite.	4	60 - 64
Limestone, light-gray (N 7); sandy, sparse biosparite, allochems abraded, moldic; 25 percent quartz, coarse to fine, angular to subrounded, moderately sorted; 3 to 5 percent heavy minerals, medium to very fine, rounded to subangular; very porous; moderately to well cemented; interlayered with about 20 to 30 percent sand; quartzose, coarse to fine, angular to subrounded, moderately to well sorted; 3 to 5 percent heavy minerals, medium to fine, subangular to rounded; about 30 to 40 percent carbonates and shell pieces, very abraded.	3	64 - 67
Limestone as above; moderately cemented; interbedded with 30 to 40 percent sand as above.	3	67 - 70
Sand and limestone gravel, light-gray (N 7); quartzose as above; 5 percent heavy minerals, medium to fine, subangular to rounded; 40 percent detrital carbonates and shell pieces; interbedded with about 40 percent limestone gravel; sandy, sparse biosparite; 20 to 30 percent quartz, coarse to fine, angular to subrounded; 3 to 5 percent heavy minerals, medium to fine, subangular to rounded; loosely cemented; good porosity.	4	70 - 74
Sand, yellowish-gray (5 Y 7/2); quartzose, medium to very fine, moderately sorted, angular to subangular; 5 to 10 percent heavy minerals, medium to fine, subangular to rounded; 40 percent detrital carbonates and shell pieces.	3	74 - 77

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Sand, yellowish-gray (5 Y 7/2); quartzose, coarse to very fine, angular to subrounded, moderately sorted; 5 to 10 percent heavy minerals as above; 40 percent detrital carbonates and shell fragments, *Olivella*, *Anadara*, *Glycymeris*, coral; interbedded with about 5 percent limestone gravel; packed biosparite.	3	77 - 80
Limestone, very light gray (N 8); sandy, packed biosparite; 20 percent quartz, medium to very fine, angular to subangular; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; moderately cemented; moldic, very porous; interlayered with about 30 percent sand as above.	4	80 - 84
Limestone as above; interlayered with 10 to 20 percent sand as above.	3	84 - 87
Limestone, light-gray (N 7); sandy, sparse biosparite, abraded allochems, moldic; 20 to 30 percent quartz, medium to very fine, moderately sorted, angular to subangular; 3 to 5 percent heavy minerals as above; moderately to loosely cemented; very porous; interbedded with 10 to 20 percent sand as above.	3	87 - 90
Limestone as above; interbedded with about 30 percent sand; quartzose, coarse to very fine, angular to subangular; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; 30 to 40 percent detrital carbonates and shell pieces, very abraded.	4	90 - 94
Limestone as above; interbedded with 20 to 30 percent sand as above.	3	94 - 97
Limestone as above; interbedded with 20 percent sand as above.	3	97 - 100
Limestone, light-gray (N 7); sandy, sparse biosparite, abraded allochems; about 30 percent quartz, medium to very fine, angular to subangular; 3 to 5 percent heavy minerals as above; moderately to loosely cemented; good porosity; interbedded with about 30 percent sand; quartzose, medium to very fine, angular to subangular; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; about 30 percent detrital carbonates and shell pieces, very abraded.		100 - 104

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, very light gray (N 8) to light-olive gray (5 Y 6/1); sandy, sparse biosparite, very abraded shell pieces; 30 percent quartz, medium to very fine, angular to subangular; 3 percent heavy minerals, fine to very fine, subangular to rounded; moderately cemented; good porosity, moldic, vugs; interbedded with about 30 percent sand; quartzose, medium to very fine, moderately sorted, angular to subangular; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; 30 to 40 percent detrital carbonates and shell fragments, very abraded.	3	104 - 107
Limestone, light-olive-gray (5 Y 6/1) to pale-yellowish-brown (10 YR 6/2); sandy, sparse biosparite; in contact with sparse biomicrite, moldic, coral, very abraded shell pieces; 30 percent quartz as above; 3 percent heavy minerals as above; moderately cemented; good porosity, moldic, vugs; interbedded with about 40 percent sand, yellowish-gray (5 Y 7/2); quartzose, coarse to very fine, angular to subrounded, moderately sorted; 3 to 5 percent heavy minerals, medium to very fine, subangular to rounded; 40 percent detrital carbonates and shell fragments, very abraded, *Olivella*, *Busycon*, bivalves.	3	107 - 110
Sand, yellowish-gray (5 Y 8/1); quartzose, medium to very fine, angular to subangular; 3 to 5 percent heavy minerals as above; about 4 percent detrital carbonates and shell pieces, very abraded, echinoid spines, mollusks; interbedded with 20 to 30 percent limestone, light-olive-brown (5 Y 5/6) to light-olive-gray (5 Y 6/1); poorly washed biosparite, abundant bivalve fragments; 10 percent quartz as above; small pockets of pyrite nodules; 1 percent heavy minerals as above; loosely cemented; moderately porous; also sparse biosparite gravel as above.	4	110 - 114
Limestone, yellowish-gray (5 Y 8/1); packed biosparite, abundant oolites, shell fragments, very abraded; 20 percent quartz, medium to very fine, angular to subangular; 3 percent heavy minerals, fine to very fine, subangular to rounded; moderately to well cemented; good porosity.	3	114 - 117

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, yellowish-gray (5 Y 8/1); packed biosparite as above, oosparite in places; moderately cemented; good porosity; interbedded with about 30 to 40 percent sand; detrital and oolitic carbonates, and shell fragments, very abraded; 30 to 40 percent quartzose, coarse to very fine, angular to subangular; 3 to 5 percent heavy minerals as above.	3	117 - 120
Limestone, yellowish-gray (5 Y 8/1); sandy oosparite, abundant bivalvia; about 10 percent quartz, medium to very fine, angular to subangular; about 3 percent heavy minerals as above; moderately cemented; good porosity; interbedded with about 30 to 40 percent oolitic sand; oolitic and detrital carbonates and shell fragments, echinoid spines, mollusk fragments; 25 percent quartzose, coarse to very fine, angular to subangular; 3 percent heavy minerals, medium to very fine, subangular to rounded.	4	120 - 124
Limestone as above; interlayered with about 30 percent oolitic sand as above; *Glycymeris*, bryozoan colonies.	3	124 - 127
Limestone gravel, yellowish-gray (5 Y 8/1); oosparite; about 20 percent quartz, fine to very fine, angular to subangular; about 3 percent heavy minerals, fine to very fine, subangular to rounded; loosely cemented; good porosity; interbedded with about 40 percent oolitic sand as in the limestone.	3	127 - 130
Limestone gravel as above; quartz, medium to very fine.	4	130 - 134
Limestone, yellowish-gray (5 Y 8/1); oosparite; as above; moderately cemented; good porosity; interbedded with about 30 percent oolitic sand; oolitic and detrital carbonates, and shell fragments; 20 to 30 percent quartzose, medium to very fine, angular to subangular; 3 to 5 percent heavy minerals, fine to very fine, subangular to rounded.	3	134 - 137
Limestone as above; interbedded with about 30 percent sand as above.	3	137 - 140

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, yellowish-gray (5 Y 8/1); sparse biosparite to oosparite, mollusks, broken and abraded; echinoid spines; 10 to 20 percent quartz, medium to very fine, angular to subangular; 1 to 3 percent heavy minerals, fine to very fine, subangular to rounded; moderately to loosely cemented; good porosity; interlayered with about 30 to 40 percent sand; detrital and oolitic carbonates and shell fragments; about 20 percent quartzose as above; 3 percent heavy minerals as above.	4	140 - 144
Limestone as above; interlayered with about 30 to 40 percent sand; detrital and oolitic carbonates and shell fragments; 25 percent quartzose as above; 1 to 3 percent heavy minerals, medium to very fine, subangular to rounded.	3	144 - 147
Limestone, yellowish-gray (5 Y 8/1); packed biosparite to oosparite in places, echinoid spines, very abraded mollusk fragments; about 20 percent quartz as above; 3 to 5 percent heavy minerals as above; well cemented; good porosity; interlayered with about 30 percent sand; detrital carbonates and shell fragments (some oolites), echinoid spines, *Glycymeris*, very abraded shell pieces; about 20 percent quartzose, medium to very fine, angular to subangular, moderately sorted; 3 percent heavy minerals as above.	3	147 - 150
Limestone as above; very porous; interlayered with about 25 percent sand as above.	4	150 - 154
Limestone gravel, yellowish-gray (5 Y 8/1); oosparite, oolites, fine to silt; 10 to 20 percent quartz, medium to very fine, angular to subangular; 1 to 3 percent heavy minerals as above; loosely cemented; good porosity; interbedded with about 40 percent oolitic sand as in the gravel.	3	154 - 157
Limestone as above; moderately to loosely cemented; moderately porous; interlayered with about 30 to 40 percent oolitic sand as above.	3	157 - 160

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Sand and gravel, yellowish-gray (5 Y 8/1) to very light gray (N 8); detrital carbonates and shell fragments, very coarse to silt size, poorly sorted, echinoid spines, mollusk pieces; about 25 percent quartzose, coarse to very fine, poorly sorted, angular to subangular; 1 to 3 percent heavy minerals, fine to silt, subangular to rounded; interbedded with about 30 to 40 percent limestone gravel, packed biosparite; about 25 percent quartz as in sand; 1 to 3 percent heavy minerals as in sand; loosely cemented; good porosity.	4	160 - 164
Sand, yellowish-gray (5 Y 8/1); detrital carbonates and shell fragments as above; about 30 percent quartzose as above; 3 to 5 percent heavy minerals and phosphates, medium to very fine, subangular to rounded; interbedded with about 5 to 10 percent limestone gravel as above.	3	164 - 167
Limestone, yellowish-gray (5 Y 8/1); sparse biosparite to packed biosparite in places, allochems abraded; 10 to 20 percent quartz, medium to very fine, angular to subangular; 3 percent heavy minerals and phosphates, medium to very fine, subangular to rounded; very well cemented; good porosity.	3	167 - 170
Limestone, yellowish-gray (5 Y 8/1) to very light gray (N 8); as above; 3 to 5 percent heavy minerals and phosphates as above; moderately to loosely cemented; good porosity; interbedded with about 30 percent sandy shell, detrital carbonates and shell fragments, very coarse to silt size, poorly sorted, echinoid spines, abraded mollusks; 30 percent quartzose, coarse to very fine, angular to subangular, moderately to poorly sorted; 3 to 5 percent heavy minerals and phosphates, coarse to very fine, subangular to rounded.	4	170 - 174
Limestone, light-gray (N 7); sparse biosparite, allochems very abraded; about 20 to 30 percent quartz, medium to very fine, angular to subangular; 5 percent heavy minerals and phosphates, medium to very fine, subangular to rounded; moderately to loosely cemented; good porosity; interbedded with about 40 percent sand; quartzose, coarse to very fine, moderately sorted, angular to subrounded; 5 percent heavy minerals and phosphates, coarse to very fine, subangular to rounded; 30 to 40 percent detrital carbonates and shell fragments, very abraded.	3	174 - 177

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, yellowish-gray (5 Y 8/1) and light-gray (N 7); yellowish-gray limestone as in 167 to 170 feet; well cemented; light-gray limestone as above; loosely cemented; interbedded with about 40 percent sand; quartzose, coarse to very fine, angular to subangular, moderately to poorly sorted; 5 to 10 percent heavy minerals and phosphates, coarse to very fine, subangular to rounded; 20 percent detrital carbonates and shell pieces, very abraded.	3	177 - 180
Sand and gravel, light-gray (N 7); quartzose as above; 5 to 10 percent heavy minerals and phosphates as above; 10 to 20 percent detrital carbonates and shell fragments as above; interbedded with about 40 percent limestone gravel; sparse biosparite, allochems very abraded; 30 to 40 percent quartz as in sand; 5 to 10 percent heavy minerals and phosphates as in sand; loosely cemented; good porosity.	4	180 - 184
Sand, light-gray (N 7); quartzose, coarse to very fine, moderately to poorly sorted, angular to subrounded; 10 percent heavy minerals, coarse to silt, subangular to rounded; 10 percent detrital carbonates and shell fragments, very coarse to fine, poorly to moderately sorted, very abraded; 10 to 20 percent loosely cemented limestone gravel as above.	3	184 - 187
Sand as above; interbedded with about 10 to 20 percent sandstone; quartz as in sand; 10 percent heavy minerals and phosphates as in sand; about 10 percent shell pieces; sparite matrix; moderately cemented; moderately porous.	3	187 - 190
Limestone, light-olive-gray (5 Y 6/1); sandy, sparse biosparite, very abraded allochems; 40 to 50 percent quartz, medium to very fine, angular to subangular; 10 percent heavy minerals and phosphates as above; grades into sandstone in places as above; moderately to loosely cemented; moderately to slightly porous; interbedded with 40 percent sand, very light gray (N 8), as above.	4	190 - 194

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Sand, very light gray (N 8); quartzose as above; 10 to 20 percent heavy minerals and phosphates, very coarse to silt, poorly to moderately sorted, subangular to rounded; about 10 percent detrital carbonates and shell pieces; interbedded with about 20 percent limestone and sandstone gravel as above; loosely cemented.	3	194 - 197
Limestone and sandstone gravel as above; interbedded with about 40 percent sand as above.	3	197 - 200
Same as above.	4	200 - 204
Limestone gravel, light-olive-gray (5 Y 6/1); sandy, fossiliferous micrite; 40 percent quartz, medium to very fine, angular to subangular; 10 percent heavy minerals and phosphates, coarse to silt size, subangular to rounded; loosely cemented; vugs, slightly porous; interbedded with about 30 to 40 percent sand; quartzose, medium to very fine, angular to subangular; 10 percent heavy minerals and phosphates, coarse to silt size, subangular to rounded; 10 percent shell pieces and micrite.	3	204 - 207
Limestone gravel and sand as above.	3	207 - 210
Limestone gravel, light-gray (N 7) to yellowish-gray (5 Y 8/1); as in 204 to 207 feet; interbedded with about 30 percent sand as in 204 to 207 feet.		210 - 214
Sand, yellowish-gray (5 Y 8/1) to light-olive-gray (5 Y 6/1); quartzose, fine to very fine, moderately sorted, angular to subrounded; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 5 percent shell pieces, medium to very fine; 2 to 5 percent micrite and silt; interbedded with about 10 percent limestone gravel; fossiliferous micrite; 40 percent quartz as in sand; 10 percent heavy minerals as in sand; loosely cemented; slightly porous.	3	214 - 217
Sand with limestone gravel as above.	3	217 - 220
Sand, very light gray (N 8) to yellowish-gray (5 Y 8/1); quartzose, fine to very fine, moderately sorted, angular to subrounded; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; about 5 percent shell pieces and micrite; interbedded with about 10 to 15 percent limestone gravel as above.	4	220 - 224

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone gravel, yellowish-gray (5 Y 8/1); sandy, fossiliferous micrite (dismicrite in places); 40 percent quartz, fine to very fine, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; loosely cemented; slightly porous; interbedded with about 30 to 40 percent sand as above.	3	224 - 227
Limestone gravel, light-olive-gray (5 Y 6/1) grades into sandstone in places; fossiliferous micrite as above; interbedded with about 30 percent sand; quartzose, fine to silt size, subrounded to angular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 5 to 10 percent shell pieces and micrite.	3	227 - 230
Limestone gravel as above; interbedded with about 30 percent sand as above; 10 percent heavy minerals and phosphates, coarse to silt, subangular to rounded.	5	230 - 235
Silty sand and limestone gravel, yellowish-gray (5 Y 8/1); quartzose, fine to silt, moderately sorted, angular to subrounded; 10 percent heavy minerals and phosphates, medium to silt size, subangular to rounded; about 10 percent micrite and shell pieces; interbedded with about 40 percent limestone gravel; sandy, fossiliferous micrite; 30 to 40 percent quartz, fine to very fine, angular to subrounded; 10 percent heavy minerals and phosphates as in sand; loosely cemented; very slightly porous.	5	235 - 240
Silty sand and limestone gravel as above; quartzose, coarse to silt size; heavy minerals and phosphates, coarse to silt size.	5	240 - 245
Limestone gravel, yellowish-gray (5 Y 8/1) to light-olive-gray (5 Y 6/1); fossiliferous micrite (some sparite cement); 30 to 40 percent quartz, medium to very fine, angular to subangular; 10 percent heavy minerals and phosphates, medium to silt size, subangular to rounded; loosely cemented; slightly porous; interbedded with 30 to 40 percent sand; quartzose, fine to silt size, angular to subangular, moderately sorted; 10 percent heavy minerals and phosphates; 10 percent shell pieces and micrite.	5	245 - 250

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone gravel, light-gray (N 7) to light-olive-gray (5 Y 6/1); poorly washed biosparite; 30 percent quartz as above; 10 percent heavy minerals and phosphates as above; loosely cemented; moderately to slightly porous.	5	250 - 255
Limestone gravel, light-gray (N 7); sandy, sparse biosparite, very abraded shell fragments; 30 percent quartz, coarse to very fine, angular to subrounded; moderately to poorly sorted; 10 to 20 percent heavy minerals and phosphates, coarse to silt size, subangular to rounded, moderately sorted; loosely cemented; moderately porous; interbedded with about 30 percent sand; quartzose, coarse to very fine, angular to subrounded; 10 to 20 percent heavy minerals and phosphates, coarse to silt size, subangular to rounded; 20 to 30 percent shell fragments, abraded and chalky.	5	255 - 260
Limestone gravel, light-gray (N 7) to yellowish-gray (5 Y 8/1); as above; interbedded with about 30 percent sand as above; echinoid spines.	4	260 - 264
Limestone, gravel, light-gray (N 7) to yellowish-gray (5 Y 8/1); poorly washed biosparite; 30 percent quartz as above; 10 percent heavy minerals and phosphates as above; loosely cemented; moderately porous, moldic, vugs; interbedded with about 30 percent sand as above; 10 percent heavy minerals and phosphates.	3	264 - 267
Limestone, very light gray (N 8) to yellowish-gray (5 Y 8/1) as above; moderately to loosely cemented; interbedded with about 30 percent sand as above; barnacles.	3	267 - 270
Sand and gravel, very light gray (N 8) to yellowish-gray (5 Y 8/1); quartzose, coarse to silt size, moderately sorted, angular to subrounded; 10 percent heavy minerals and phosphates, coarse to silt size, subangular to rounded; 30 percent shell pieces, very abraded and chalky, echinoid spines, barnacles; interbedded with about 30 percent limestone gravel as above; loosely cemented.	4	270 - 274
Sand and gravel as above with about 10 to 20 percent limestone gravel as above.	3	274 - 277

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, yellowish-gray (5 Y 8/1); poorly washed biosparite, allochems very abraded; 30 percent quartz, fine to silt size, moderately to poorly sorted, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; moderately cemented; moderately to slightly porous, vugs; interbedded with about 30 to 40 percent sand as above; 30 to 40 percent shell pieces, coarse to silt size.	3	277 - 280
Sand and gravel as in 274 to 277 feet.	4	280 - 284
Limestone as in 277 to 280 feet; interbedded with sand as above.	3	284 - 287
Sand and gravel, yellowish-gray (5 Y 8/1); quartzose, fine to silt size, angular to subangular, moderately sorted; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 30 to 40 percent shell pieces, coarse to silt size, very abraded, echinoid spines; interbedded with about 20 percent limestone gravel as above; loosely cemented.	3	287 - 290
Sand as above; interbedded with about 10 percent limestone gravel as above.	4	290 - 294
Limestone gravel, yellowish-gray (5 Y 8/1); poorly washed biosprite, very abraded allochems; 30 percent quartz, fine to very fine, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt, subangular to rounded; loosely cemented; moderately to slightly porous, vugs; interbedded with about 30 percent sand as above.	3	294 - 297
Samd as above; echinoid plates and spines, bryozoans.	3	297 - 300
Limestone as above; moderately to loosely cemented; interbedded with about 30 percent sand as above.	4	300 - 304
Sand and gravel as above; 20 to 30 percent limestone gravel as above; loosely cemented.	3	304 - 307

Lithologic Log of Well PB-1603--Continued

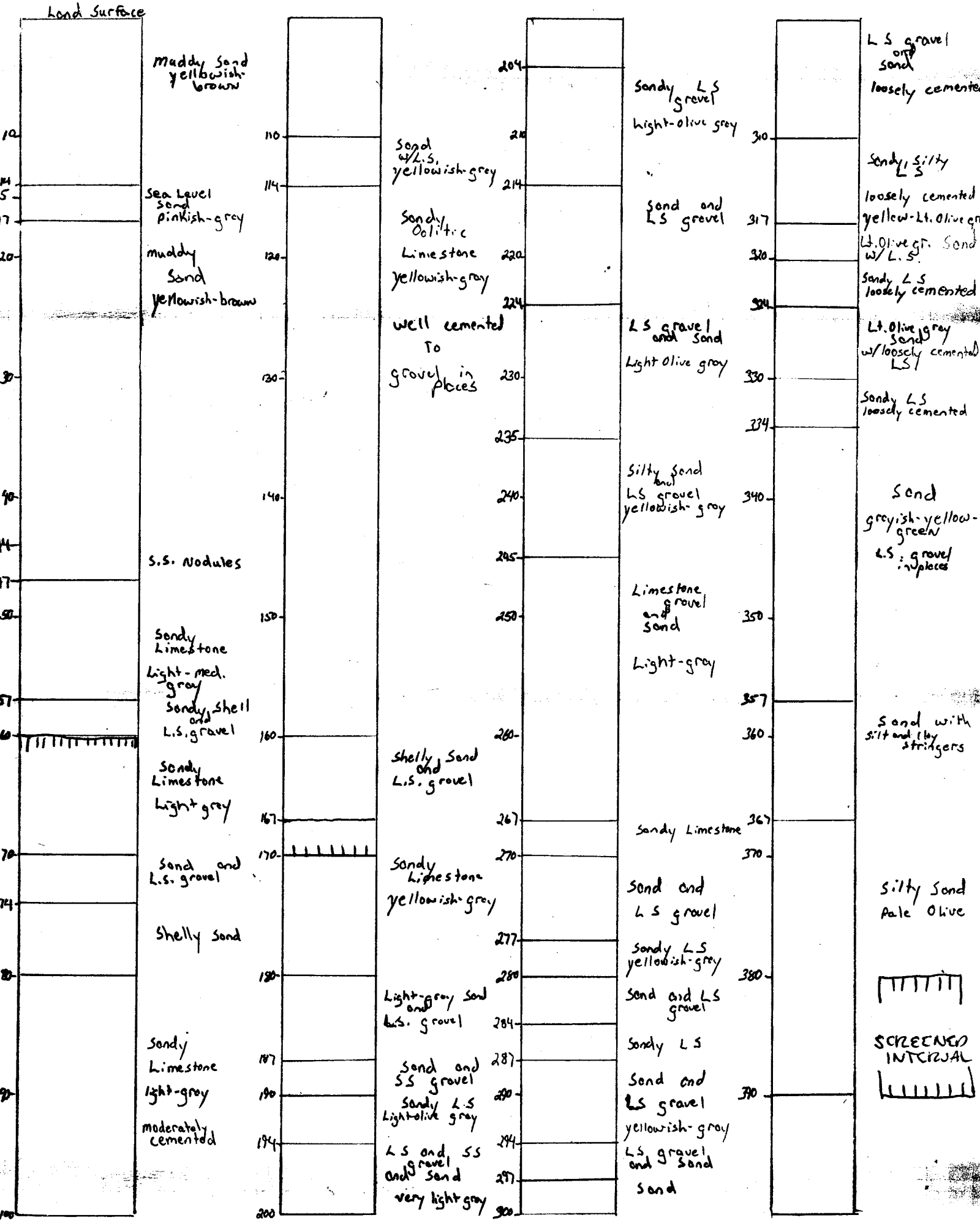
Description	Thickness (feet)	Depth, feet below land surface
Limestone gravel as above; interbedded with about 40 percent sand; quartzose, medium to silt size, moderately sorted, angular to subrounded; 10 percent heavy minerals and phosphates as above; 40 percent shell pieces, coarse to silt size.	3	307 - 310
Limestone, yellowish-gray (5 Y 8/1), poorly washed biosparite, allochems very abraded and chalky; about 30 percent quartz, fine to silt size, angular to subangular; 10 percent phosphates and heavy minerals, fine to silt size, subangular to rounded; very loosely cemented; moderately to slightly porous, moldic, vugs; interlayered with about 40 percent sand as above.	4	310 - 314
Limestone, light-olive-gray (5 Y 6/1); as above; interbedded with about 40 percent sand; shell pieces, medium to silt size, very abraded and chalky; 40 percent quartzose as above; 10 percent heavy minerals and phosphates as above.	3	314 - 317
Sand, light-olive-gray (5 Y 6/1); detrital carbonates and shell pieces, coarse to silt size, very abraded; 30 percent quartzose, fine to very fine, angular to subangular, moderately sorted; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; interlayered with about 20 percent limestone; sandy, sparse biomicrite, allochems very abraded; 20 percent quartz, fine to very fine, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; loosely cemented; slightly porous, vugs.	3	317 - 320
Limestone, light-olie-gray (5 Y 5/2); poorly washed biosparite; 30 percent quartz as above; 10 percent heavy minerals and phosphates as above; loosely cemented; slightly porous; interlayered with about 20 percent sand as above.	4	320 - 324
Sand, light-olive-gray (5 Y 5/2) as above; interlayered with about 30 percent limestone as above; some silt and clay stringers.	3	324 - 327
Sand as above; interbedded with about 10 to 20 percent very loosely cemented limestone as above.	3	327 - 330

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Limestone, light-olive-gray (5 Y 5/2); sandy, packed biomicrite, allochems very abraded; 20 percent quartz as above; 10 percent heavy minerals and phosphates as above; very loosely cemented; slightly porous, moldic, vugs; interlayered with 20 percent sand as above.	4	330 - 334
Sand, grayish-yellow-green (5 GY 7/2); very abraded shell pieces and micrite, echinoid plates, barnacles, shark teeth; 20 to 30 percent quartzose, coarse to very fine, angular to subangular, poorly sorted; 5 percent heavy minerals and phosphates as above; loosely compaced in places.	3	334 - 337
Sand as above; with about 10 percent very loosely cemented limestone gravel, packed biomicrite; 20 percent quartz, fine to very fine; 5 to 10 percent heavy minerals and phosphates, fine to silt size; moldic, slightly porous.	3	337 - 340
Sand as above; bryozoan colonies; interbedded with 10 to 20 percent limestone gravel as above.	4	340 - 344
Sand, grayish-yellow-green (5 GY 7/2); quartzose, medium to very fine, moderately to poorly sorted, angular to subangular; 30 to 40 percent shell pieces and micrite, very abraded and coated, echinoid plates and spines, barnacles, shark teeth; 5 to 10 percent heavy minerals and phosphates, medium to silt size, subangular to rounded; loosely compacted; interbedded with 10 to 20 percent limestone gravel as above.	3	344 - 347
Sand as above; loosely compacted.	3	347 - 350
Same as above.	4	350 - 354
Same as above.	3	354 - 357
Sand, grayish-yellow-green (5 GY 7/2); quartzose, medium to very fine, angular to subangular, moderately sorted; 5 to 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 30 to 40 percent shell pieces and micrite, coarse to silt size, very abraded, echinoid plates and spines, barnacles, bryozoans; about 5 percent silt and clay stringers; loosely compacted in places.	3	357 - 360

Lithologic Log of Well PB-1603--Continued

Description	Thickness (feet)	Depth, feet below land surface
Sand, light-olive-green (5 Y 5/2); quartzose, fine to very fine, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 30 to 40 percent shell pieces and micrite as above; dark-green silt and clay stringers increasing; loosely compacted.	4	360 - 364
Sand as above.	3	364 - 367
Silty sand as above; 10 percent dark-green silt clay stringers; loosely compacted.	3	367 - 370
Silty sand, pale-olive (10 Y 6/2); quartzose, fine to silt size, angular to subangular; 10 percent heavy minerals and phosphate, fine to silt size, subangular to rounded; 10 percent dark-green clay and silt stringers; 30 to 40 percent shell pieces and micrite as above.	4	370 - 374
Silty sand, pale-olive (10 Y 6/2) changes to moderate-olive-brown (5 Y 4/4) when wet; quartzose as above; 10 percent heavy minerals and phosphates as above; 30 percent shell pieces as above, oyster shells; 10 percent silt, clay, and micrite.	3	374 - 377
Sand as above.	3	377 - 380
Sand as above.	4	380 - 384
Silty sand, pale-olive (10 Y 6/2); quartzose, medium to very fine, angular to subangular; 10 percent heavy minerals and phosphates, fine to silt size, subangular to rounded; 30 percent shell pieces, coarse to silt size, very abraded; 10 percent silt and clay and micrite.	3	384 - 387
Silty sand, light-olive-gray (5 Y 5/2); quartzose, medium to silt size, angular to subangular, moderately sorted; 10 percent heavy minerals and phosphates, medium to silt size, subangular to subrounded; 30 percent shell pieces, coarse to silt size, very abraded; 10 percent silt, clay, and micrite.	3	387 - 390


Land Surface
Muddy Sand yellowish-brown
Sea Level
Sand pinkish-gray
muddy Sand yellowish-brown
S.S. Nodules
Sandy Limestone Light-med. gray
Sandy Shell and L.S. gravel
Sandy Limestone Light-gray
Sand and L.S. gravel
Shelly Sand
Sandy Limestone Light-gray
moderately cemented
Sand w/L.S. yellowish-gray
Sandy Oolitic Limestone yellowish-gray
well cemented To gravel in places
Shelly Sand and L.S. gravel
Sandy Limestone yellowish-gray
Light-gray Sand and L.S. gravel
Sand and SS gravel
Sandy L.S Light olive gray
L.S and SS and gravel Sand very light gray
Sandy L.S gravel light-olive grey
Sand and L.S gravel
L.S gravel and Sand Light Olive gray
Silty Sand and L.S gravel yellowish-gray
Limestone gravel and Sand Light-gray
Sandy Limestone
Sand and L.S gravel
Sandy L.S yellowish-gray
Sand and L.S gravel
Sandy L.S
Sand and L.S gravel yellowish-gray
L.S, gravel and Sand
Sand
L.S gravel or Sand loosely cemented
Sandy L.S Silty L.S loosely cemented yellow-Lt. Olive gr
Lt. Olive gr. Sand w/L.S.
Sandy L.S loosely cemented
Lt. Olive gray Sand w/loosely cemented L.S
Sandy L.S loosely cemented
Sand grayish-yellow-green L.S gravel in places
Sand with silt and clay stringers
Silty Sand Pale Olive
SCREENED INTERVAL

APT Analysis

SITE: USGS Site 5
Section 13 Township 45S Range 42E

REPORT:

GEOLOGIC DATA:

Site ~~geology~~ lithology is based on ~~cutting~~ we ~~PB 1603~~ cuttings from well PB-1603 as described by ~~Don Padgett and Bill Barfkenecht (SFWMD).~~ SFWMD staff. ~~the cuttings were excellent since the well was drilled~~ The well was drilled with a dual cased reverse ~~art~~ air rig so the cuttings' quality is excellent.

0'-47' Muddy sand (low to very low ~~permeability~~ K)
47'-60' Sandy limestone with sand (medium to low K)
60'-110' Solutioned limestone with ~~some~~ sand & shell (Turnpike aquifer, high to very high K)
110'-130' ~~1143~~ Limestone w/ ~~some~~ sand and shell (low to medium K)
130-144 Solutioned limestone w/ sand & shell (medium to high K, possibly Turpike)
144-207 Limestone with sand & shell (low to medium K)
207-~~224~~ 255 Sandstone with sand (low ~~K~~ to medium K)
~~224-255~~
255-~~324~~ 320 Limestone w/ sand & shell (low K)
~~320~~ 329-330 Limestone, sand, silt (low to very low K)
330-384 Sand with limestone (low K)
384-390 Sand, shell, silt, and clay (very low K, top of Hawthorn Formation)

Based on these descriptions, estimated aquifer thickness is 327'.

The Turnpike Aquifer (zone of secondary permeability) extends from ~~a~~ 60 - 110' bg. with another possible stringer from 130-144' bg.

Site elevation is approximately feet NGVD.

Depths to water is ~~approximately~~ at least 5 feet.

WELL DESCRIPTIONS:

Well	Diam. (in)	Total Depth (ft)	Cased Depth (ft)	Screen/ Open	r (ft)
PB-1604	6	170	60	screen	3
PB-1603		170	60	screen	30

INFLUENCING FACTORS:

1) Interference from a nearby irrigation well was noted near the end of the test.

APT:

Started: 2/17/87
Duration: 360 minutes
Discharge: 335 GPM to
Recovery: None

Comements:

1) Water were measured with chalked tape.
2) The first drawdown measurement was taken 2.25 minutes into the test; ~~80%~~ 54% of the total drawdown had occurred at this point.

USGS ANALYSIS:

Method: Jacob

Results: T = 19,700 FT^2/DAY
S = not computed

Comments:

1) The analysis assumes that the ~~sands and shell~~ muddy sand over the production zone acts as a confining layer for short pumping periods. Permeability of these sands is estimated at 24 ft/day ~~with~~ based on grain size analysis with vertical permeability 2 to 10 times lower.

SFWMD ANALYSIS

Method: Jacob

Results: T = 20,000 FT^2/DAY
S = .0011

Comments:

1) Results are in excellent aggreement with the USGS results.
2) For the method to be strictly applicable both the layer above ~~the p~~ and the layer below the producing zone would have to act as confining. Although this assumption is not unreasonable given the relative permeabilities of the layers, it is not possible to check it without wells in the nonproducing zones. Most likely, the aquifer behaves as semi-confined.

RECOMMENDED VALUES:

~~The~~ A T of 20,000 FT²/DAY ~~See~~ is accepted based on the pump tests. The problem lies in determining ~~which zone~~ what portion of the aquifer the T actually applies to. If it is assumed to apply to the screened interval of 60 to 170 feet, ~~the materials in~~ the K for the interval is 180 feet day. It is likely however, that most of the discharge came from the Turnpike zones which total 64 feet ~~in the~~ within the interval. Applying the T only to these zones gives a permeability of 300 FT/DAY to the Turnpike ~~2~~ interval.

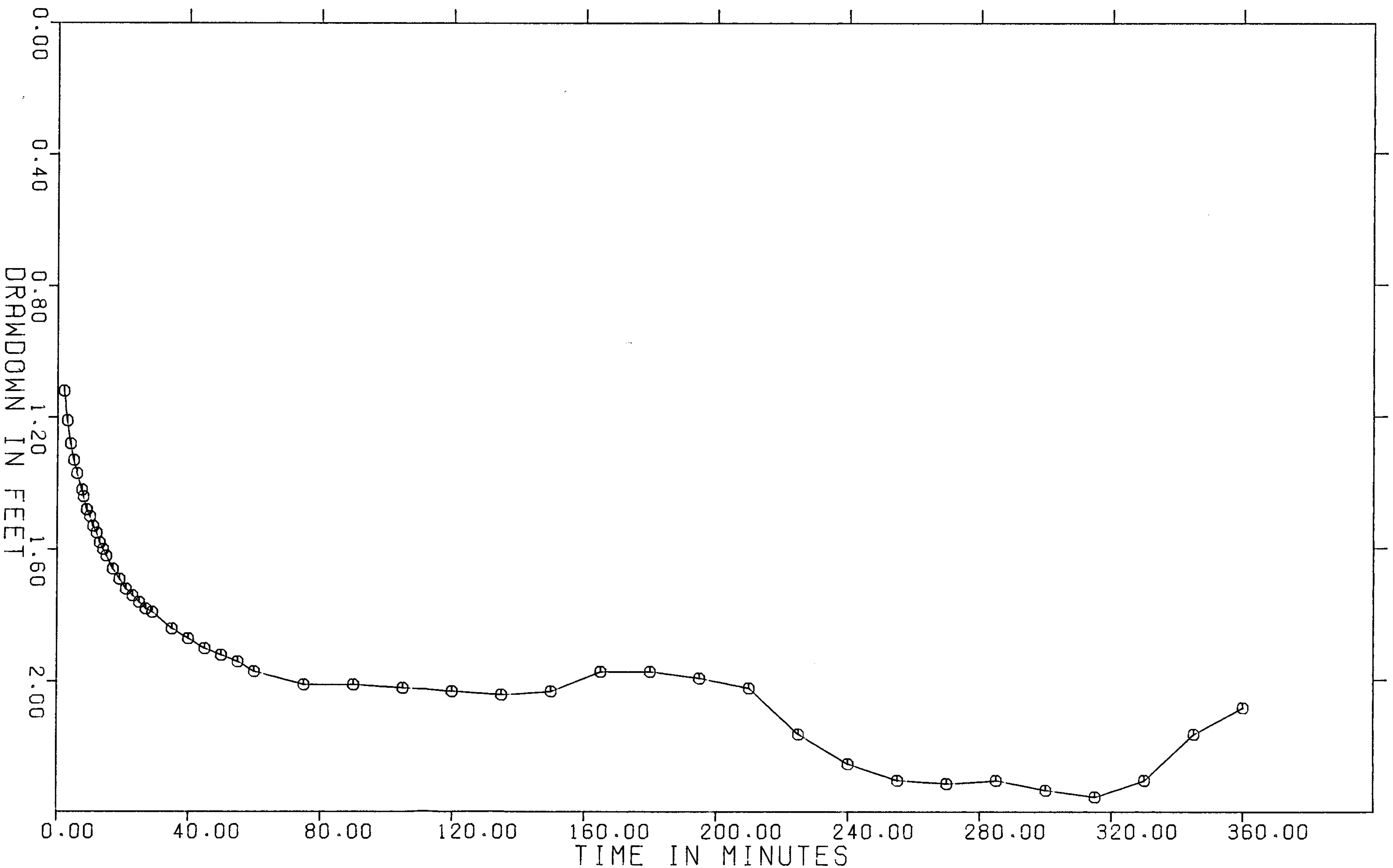
The storage coefficient is viewed as a maximum possible compressive ~~one~~ storage value for the site since it was likely influenced by leakage from above and/or below the pumped zone.

WMD TAPENO 6230 PLOT NO 0004 TIME 09:17
USER NO SHINE DATE 87/08/20

USGS TIME-DRAWDOWN SITE 5

OBSERVATION WELL: PB 1603

R= 30 Q= 335



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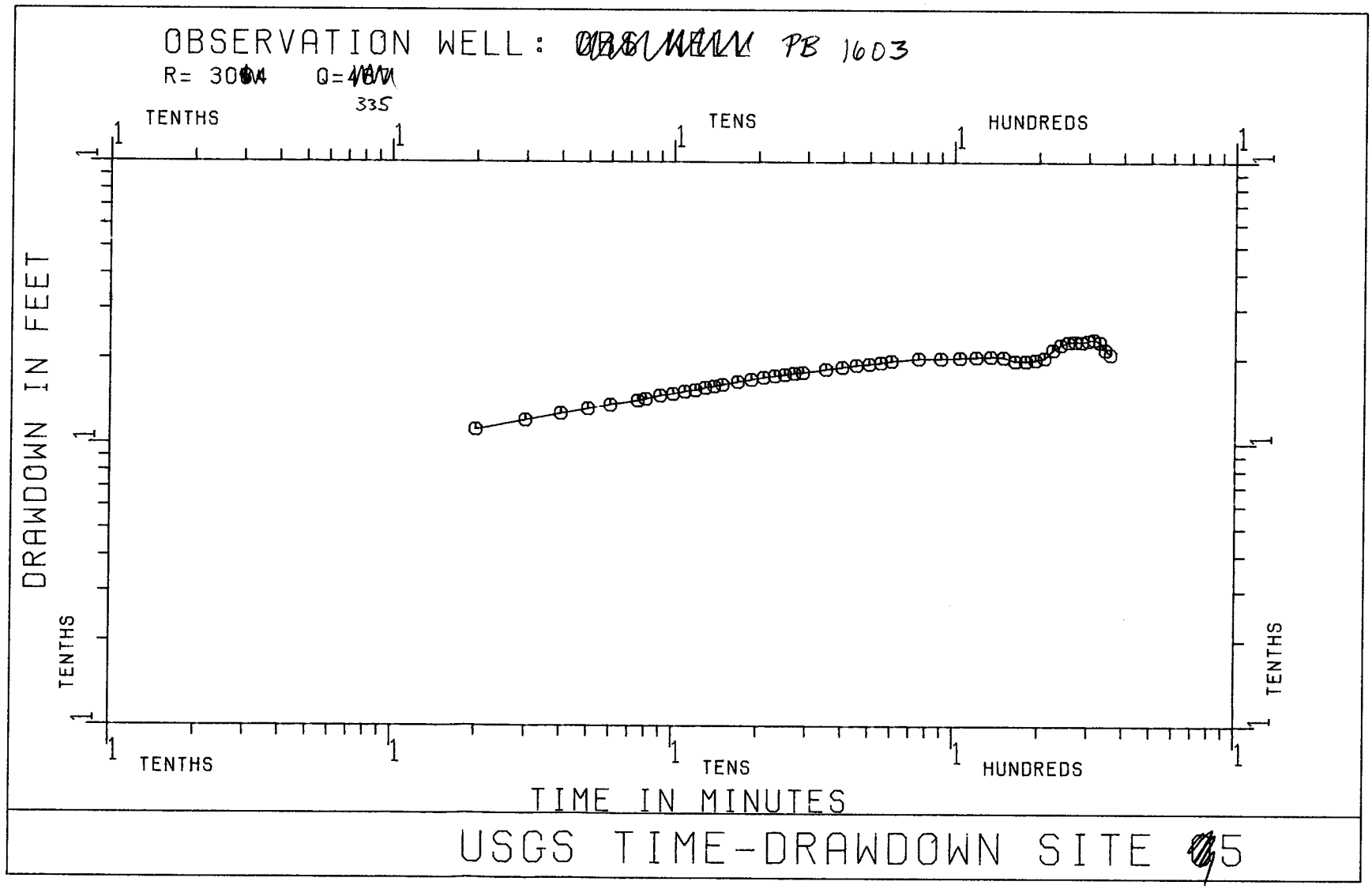
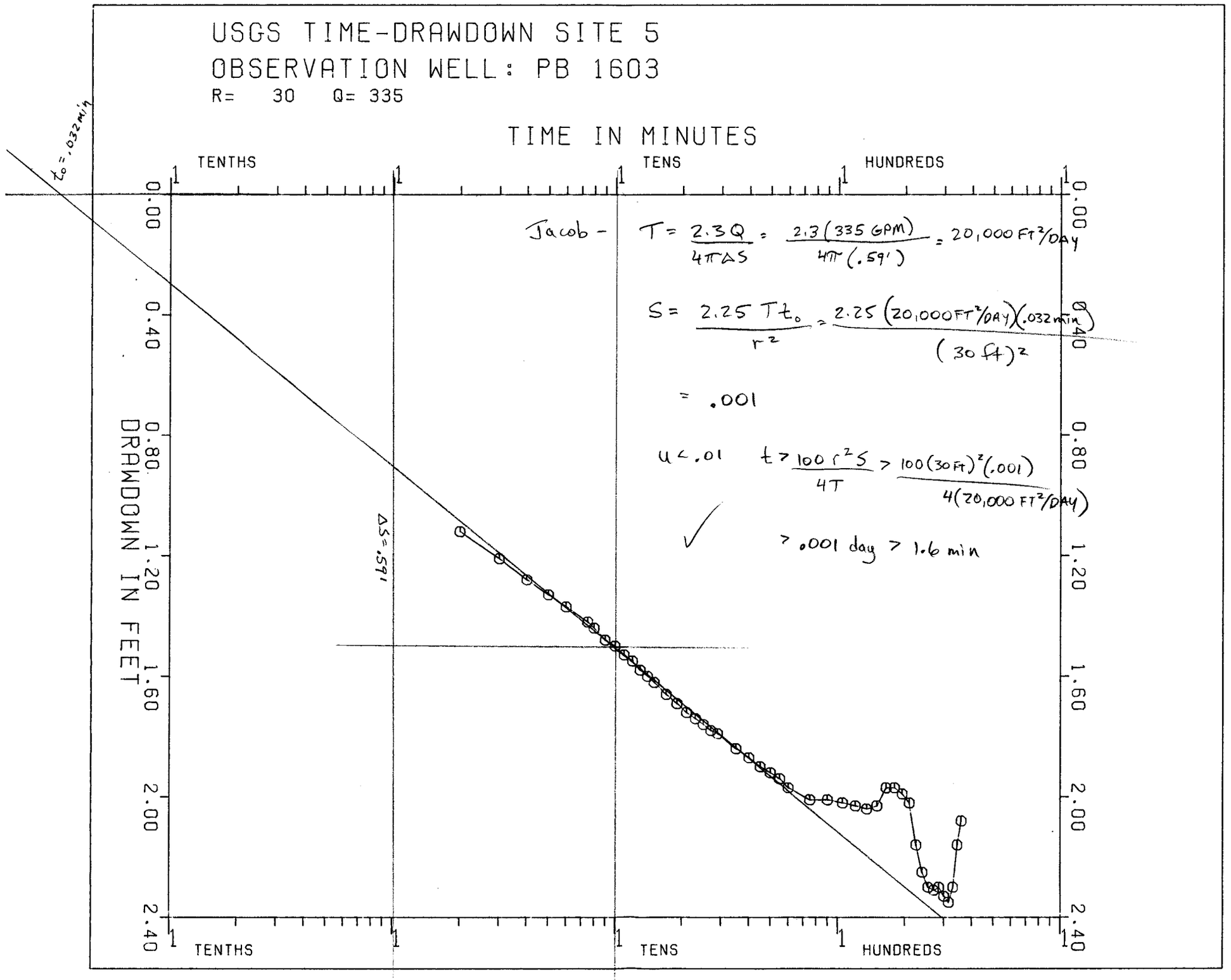
USER NO SHINE DATE 87/04/30 TIME 13:17





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