King County

AQUIFER TEST IN THE

MAPLE VALLEY AREA

Purpose of the Test

At the request of the Northwest Region, Department of Ecology, an aquifer test was conducted during November 1975 in the Maple Valley area. The purpose of the test was to observe the effect of pumping on the water levels of selected nearby wells, to determine the hydraulic characteristics of the principal aquifer in the area, and to project water-level declines in the area based on information derived from the test. The test was conducted by the Water Resource Investigation Section and personnel involved included Peder Grimstad, Paul Eddy, Chuck Cline, and Harry Tanaka.

Geology of the Maple Valley Area 1/

The Maple Valley area is overlain by glacial till, a compact mixture of gravels and occasional boulders in a grassy, clayey, silty-sand matrix. The till generally is 10 to over 50 feet thick, and forms a relatively thin, nearly impermeable blanket over most of the drift plain. Underlying the till mantle is the Pre-Vashon Undifferentiated Drift. The drift consists principally of several layers of till separated by fluvial sand and gravel, and a thick sequence of sand, silt, peat, and gravel. Most of the shallow domestic wells obtain water from the upper part of the drift, separated from the deeper, more permeable zone, by less permeable layers of silt and clay. Results of the aquifer test show that the hydraulic connection between the shallow and deep wells is very small.

Aquifer Test

An aquifer test was made on the Brandt well (T. 22 N., R. 6 E., sec. 15A), Maple Valley, on November 12 and 13, 1975. The test well was drilled 230 feet

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1/ Geologic information from: Luzier, J. E., 1969, Geology and Ground-Water Resources of Southwestern King County, Washington, Washington Dept. of Water Resources Water-Supply Bull. 28, 260 p.

deep through glacial drift material consisting of sandy clay, clay, and gravels mixed with clay. The well is cased with an 8-inch diameter casing from the surface to 210 feet, and finished with an 8-inch stainless steel screen from 210 to 230 feet. Water levels were measured in six domestic wells during the test but only the two deep wells showed any significant water-level change. The two wells, 260 and 275 feet deep, penetrated to about the same altitude as the pumped well. The four shallow wells ranged in depth from 136 to 225 feet. A well location and altitude of the test and observation wells is shown (Fig. 1). The depth of these wells in relation to the pumped well is shown in Figure 2. Pumping started at 12 noon, November 12, 1975. The amount of water pumped, measured by a Sparling Meter, averaged about 80 g.p.m. (gallons per minute) during the test (Fig. 3). The pumped water was discharged into a nearby gully and into the Cedar River. The water-level data collected during the test on the Brandt, Ward, and Ladd wells are included in Appendices A1, A2, and A3.

The coefficients of transmissivity (T) and storage (S) were determined by the Theis nonequilibrium and modified nonequilibruim methods. Values obtained by both methods for the three deep wells are tabulated below for comparison. Plot of curves and calculations are included in Appendices B1 through B6.

Well	Theis Nonequilibrium	Modified Nonequilibrium
Brandt	T = 1146 gpd/ft S (not computed)	T = 1221 gpd/ft S (not computed)
Ward	T = 1146 gpd/ft $S = 3.12 \times 10^{-5}$	T = 1221 gpd/ft $S = 2.61 \times 10^{-5}$
Ladd	T = 1265 gpd/ft $S = 2.37 \times 10^{-5}$	T = 1265 gpd/ft $S = 2.61 \times 10^{-5}$

The shape of the time-drawdown curves (B4, B5, B6) shows that several hydrologic boundaries were intercepted, indicated by the abrupt changes in slope.

Each break in the slope of the curve is the result of a particular boundary condition being reflected back to the observation well from the boundary. In the test area, the most likely boundary condition to be encountered is the steep bluff about 1,000 feet to the south and west of the pumped well. Also, variations in aquifer thickness and pinching out of the water-bearing zones, characteristic of glacially-deposited sediments, would give similar results.

Figure 2 shows the altitude, depth and relative position of the static and pumping water levels of each well. Also shown is the approximate altitude of the Orchard Grove and Dorre Don springs relative to the static and pumping head in the wells. The Orchard Grove spring, or any similarly situated spring in this area, could be affected depending on whether the source of the spring is derived from the shallow or deep zones. If the source of spring water is from the shallow zone, there is no immediate problem; if the source is derived essentially from the aquifer zone pumped by the deep wells, the spring flow could be reduced or stopped by the head loss resulting from any substantial increase in pumping from the aquifer.

Figures 4 and 5 are projected curves that show the relationship between drawdown and distance from a well pumping at a constant rate of 45 g.p.m. and 30 g.p.m. for selected periods of time under ideal conditions (infinite aquifer, no recharge or discharge). Although the ideal conditions are not met, the curves are useful because they indicate the magnitude of drawdown that can be expected under sustained pumping periods. In most cases, under real conditions, the drawdowns will be greater than indicated by the curves.

Conclusions

As a result of the aquifer test, the following conclusions are made:

1. The transmissivity and storage coefficients of the aquifer are relatively small. Consequently, pumping effects (lowering of head) spread rapidly and for considerable distances.

2. Topography and geology are major boundary conditions that limit the effectiveness of the aquifer.

3. A reasonable pumping rate would keep the water level in the Ward and Ladd wells safely above the pump setting.

4. A potential problem is the effect of additional pumping on spring flow. Orchard Grove spring, serving over 30 homes, is especially critical. Needed is a study relating the source of the spring flow to the aquifer.

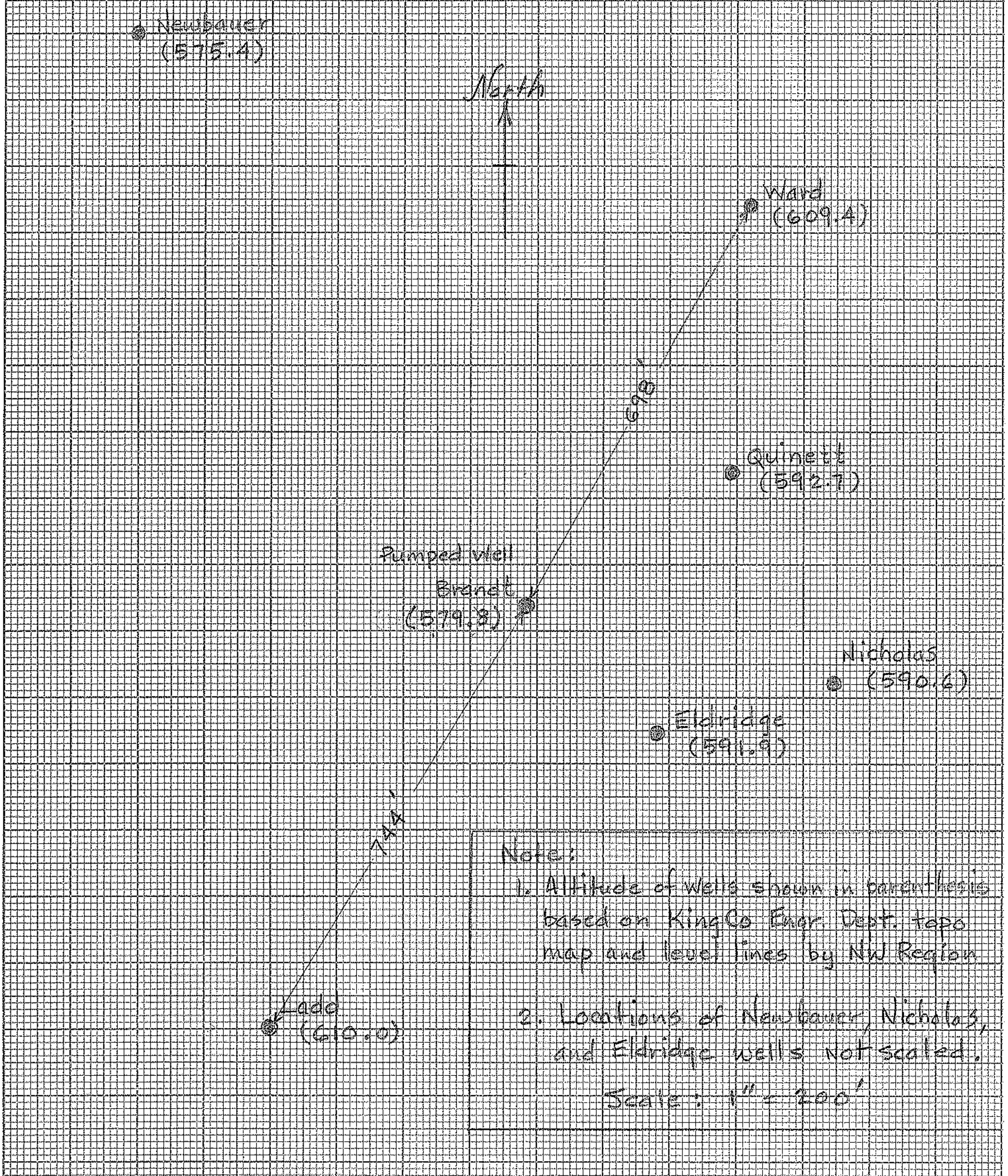

FIGURE 1.-- Well location of test and observation wells in Maple Valley.

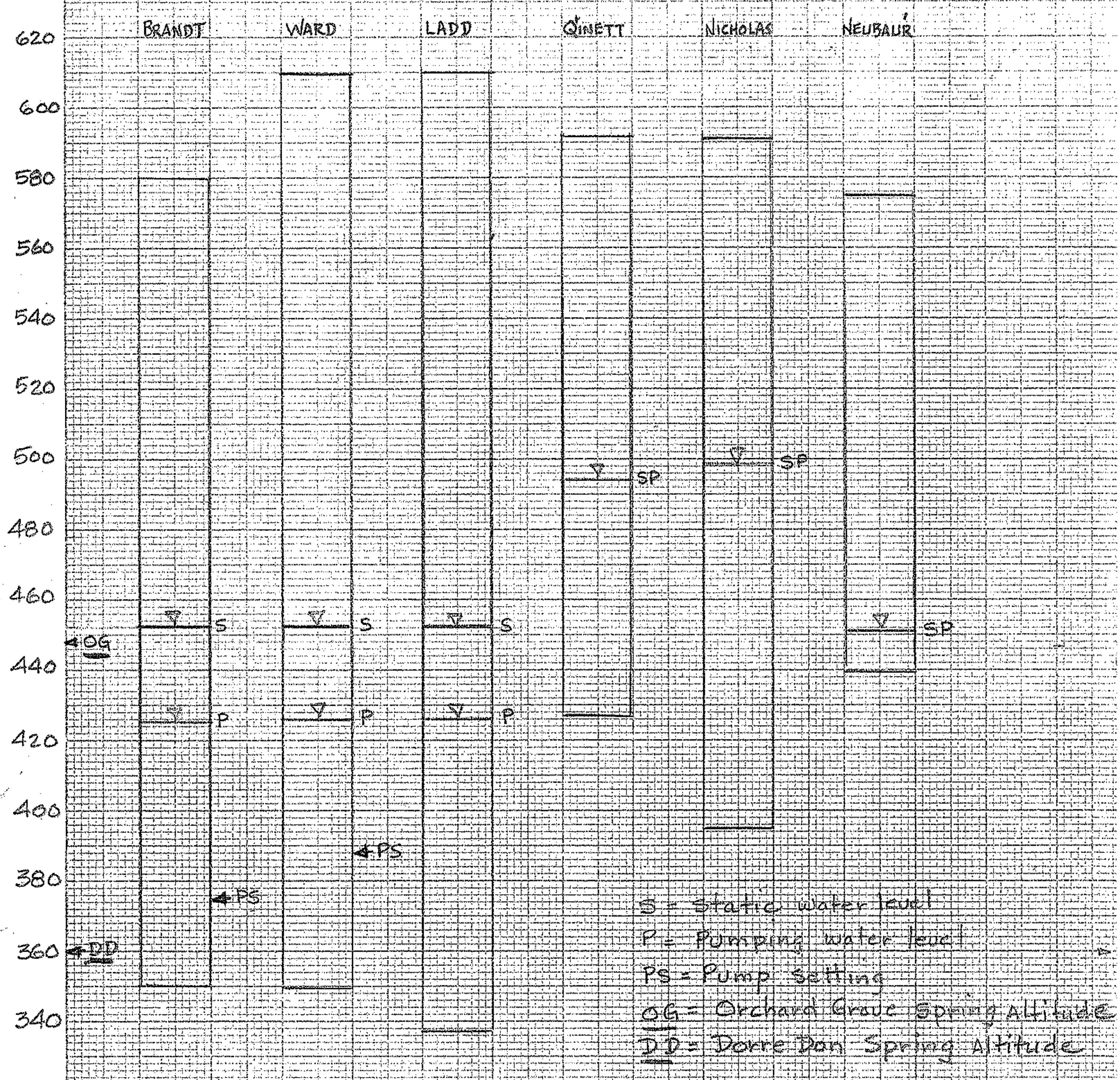

FIGURE 2.--ALTITUDE, DEPTH, AND RELATIVE POSITION OF THE STATIC AND PUMPING LEVEL OF WELLS MEASURED DURING AQUIFER TEST

K&E 10 X 10 TO ½ INCH 47 1323
10 X 15 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

K+E 10 X 10 TO ½ INCH 47 1323
10 X 15 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

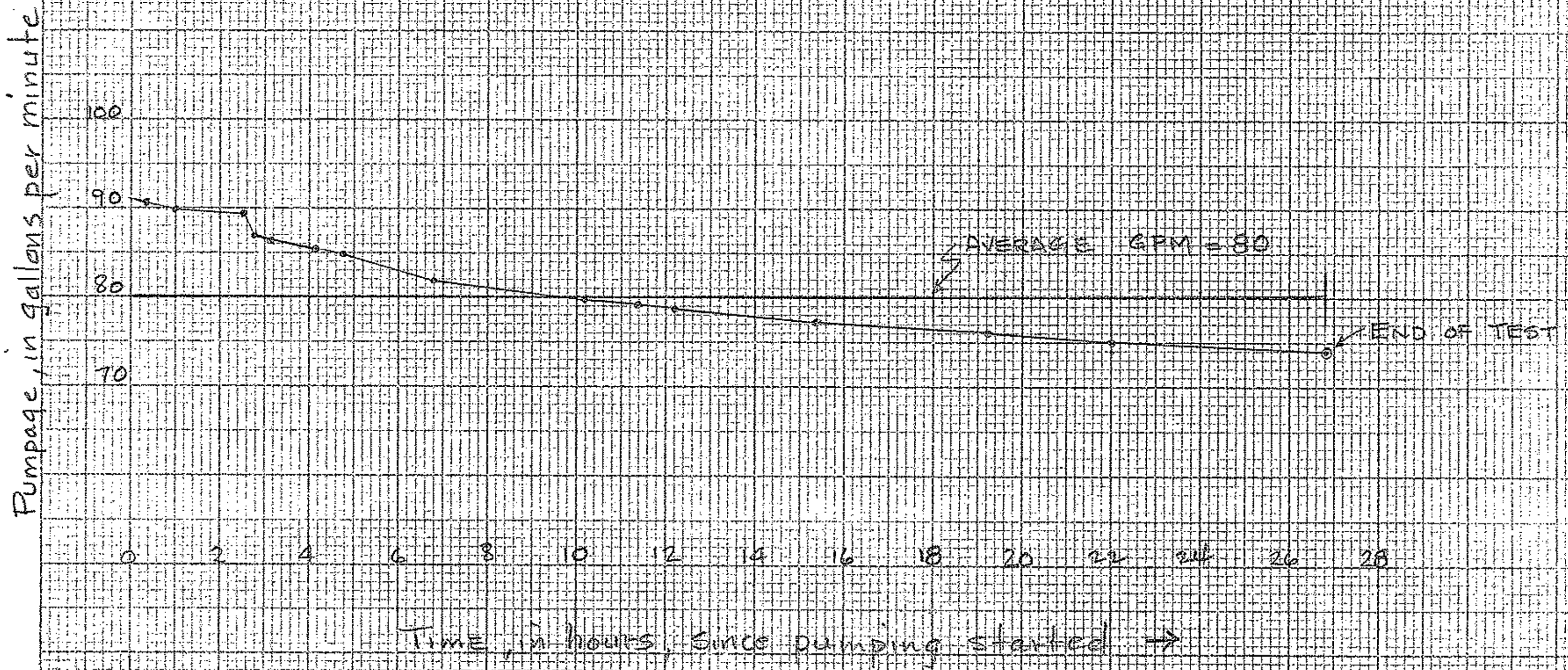

Figure 3. - Rate of pumping vs. time

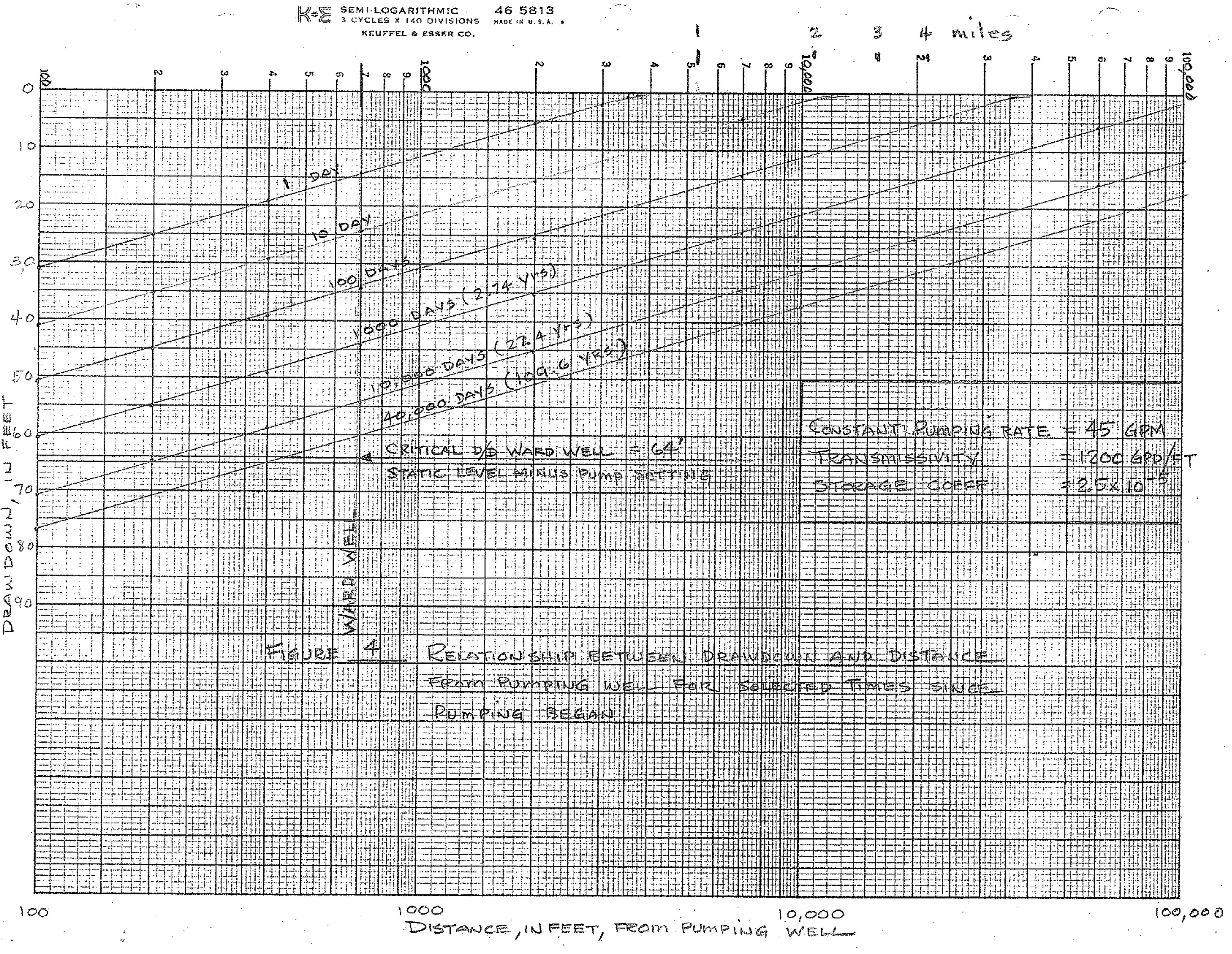

FIGURE 4 RELATIONSHIP BETWEEN DRAWDOWN AND DISTANCE FROM PUMPING WELL FOR SELECTED TIMES SINCE PUMPING BEGAN

K+E SEMI-LOGARITHMIC 3 CYCLES X 140 DIVISIONS KEUFFEL & ESSER CO. 46 5813 MADE IN U.S.A.

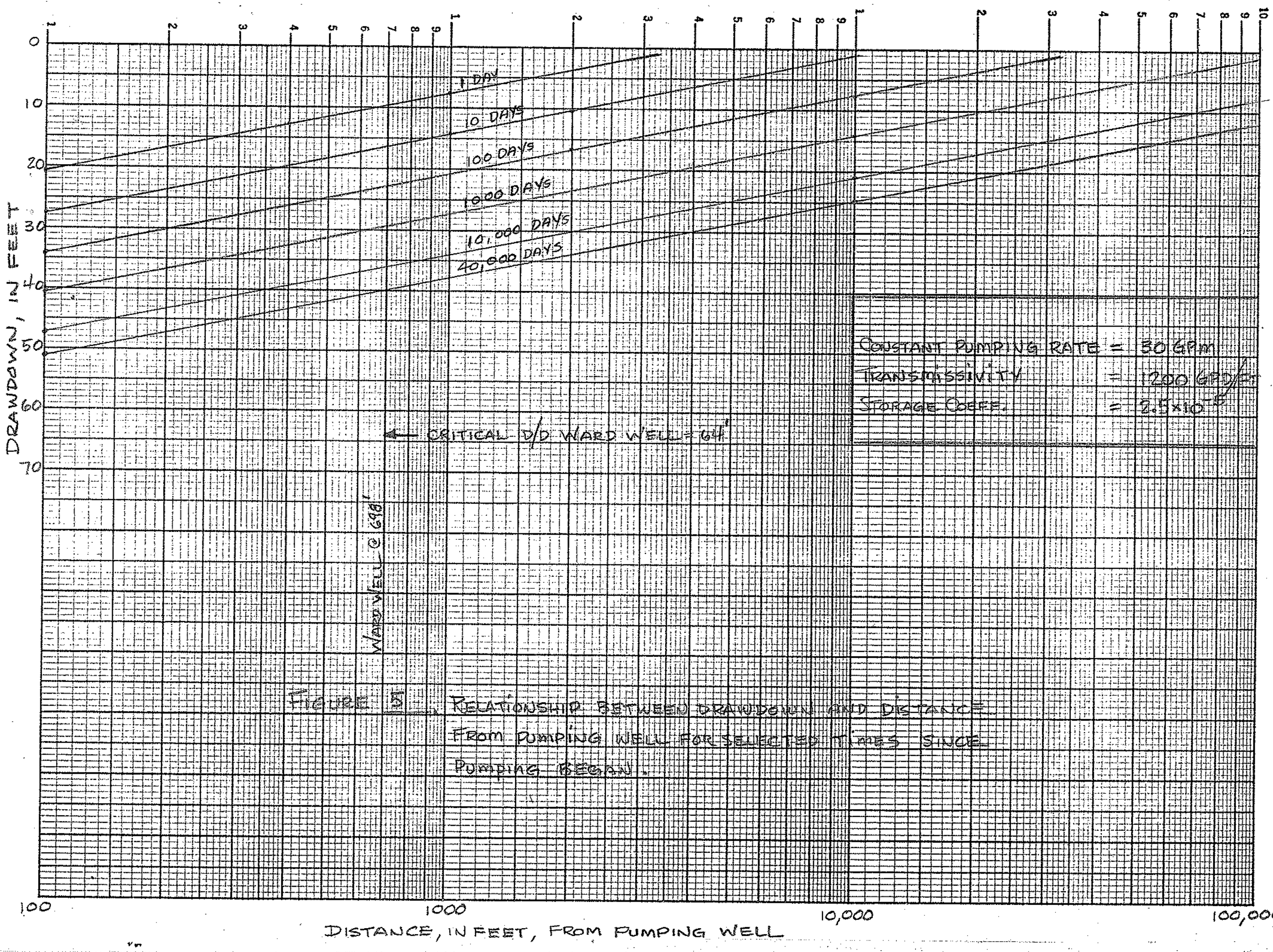

FIGURE 5. RELATIONSHIP BETWEEN DRAWDOWN AND DISTANCE FROM PUMPING WELL FOR SELECTED TIMES SINCE PUMPING BEGAN.