ESTIMATED DRAWDOWN OF WATER LEVELS AND DEGREE OF HYDRAULIC INTERFERENCE BETWEEN AN EXISTING AND A PROPOSED WELL, MOXEE VALLEY, YAKIMA COUNTY, WASHINGTON

by H. H. Tanaka

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At the request of the State of Washington Department of Water Resources, the U.S. Geological Survey has undertaken the following brief analysis of a potential ground-water-management problem in the eastern part of the Moxee Valley, Yakima County. The question is, how much drawdown of ground-water levels would result if a proposed irrigation well (S. Martinez) 1,000 feet deep and pumping 4,000 gpm (gallons per minute) were constructed 1,250 feet distant from an existing irrigation well (M. Fines) that is 755 feet deep and pumps 2,000 gpm, if both wells pump continuously for 180 days? The Fines well is located in the NW¼NW¼ sec. 25, T. 12 N., R. 21 E. The proposed well would be located in the SW¼SW¼ sec. 24, T. 12 N., R. 21 E.

A driller's log of the Fines well (fig. 1) indicates that the well penetrates clay, gravel, sand, and basalt flows interbedded with sedimentary materials to a depth of 480 feet, and a continuous basalt sequence below that depth. The material overlying the continuous basalt is sealed off by the well casing and the yield of water to the well is from the continuous basalt. The logs and casing record of two other deep wells to the west show similar logs and cased zones (fig. 1). The casing depths are different in those other wells because the depth of the material overlying the continuous basalt changes in the interval between the wells.

Although the hydraulic characteristics of the water-bearing basalt in the vicinity of the wells are not known, certain assumptions can be made, based upon knowledge of the Fines well and on the hydraulic character of the same type of basalt in other parts of eastern Washington, to serve as the basis for a rough analysis of the question stated above. For this analysis, the following assumptions were made:

1. The transmissivity of the basalt zone tapped by the Fines well is assumed to be 50,000 gallons per day per foot. This estimate is based upon a rule-of-thumb calculation of 2,000 times the specific capacity of the well (25 gallons

per minute per foot of drawdown) and similar values of transmissivity derived from aquifer tests elsewhere in eastern Washington.

2. The storage coefficient of $1x10^{-3}$ is based on storage values computed from aquifer tests in the Columbia Basin, and values obtained in the Odessa area by comparing the volume of water pumped to the volume of the aquifer dewatered. The computations also were made with a storage coefficient of $1x10^{-4}$ to provide an extreme range for comparison.

3. If the proposed well is drilled to a depth of 1,000 feet, it doubtless will penetrate the basalt interflow zones that provide water to the Fines well and deeper basalt zones, which also may be water bearing, below the bottom of the Fines well. To obtain a yield of 4,000 gpm it is assumed that the proposed well will pump about 2,000 gpm from the interflow zones that provide water to Fines well, and the remainder of the yield from water-bearing zones below.

4. The interconnection between the Fines well-zone and the deeper zone is assumed to be negligible and is not considered in the computation.

The Theis nonequilibrium equation (referenced later) was used to predict the drawdown as a result of pumping one well or as a result of pumping both wells for one irrigation season (180 days). The results as computed from the Theis equation may suggest a degree of precision that is not intended in this paper. All drawdowns shown in the following illustrations should be considered only as approximations.

Figure 2 is a family of curves which show the drawdown at various times at a nonpumping well 1,250 feet away from a well that pumps either 2,000, 3,000, or 4,000 gpm, with the storage coefficient of the aquifer assumed to be $1x10^{-3}$ (solid lines) or $1x10^{-4}$ (dashed lines) and the transmissivity 50,000 gpd/ft. Figure 3 is a family of curves which show drawdown at various distances if a well pumps either 2,000, 3,000, or 4,000 gpm for 180 days when the storage coefficient of the aquifer is $1x10^{-3}$ or $1x10^{-4}$. Figure 4 is based on the data in figures 2 and 3 shows the pumping level at Fines well if the storage coefficient of the aquifer is $1x10^{-3}$ and the Fines well and proposed well pump at the rates indicated.

The depths to the pumping levels from land surface (fig. 3) are the total of: (1) the drawdown produced in the Fines well (at an effective radius of 1 ft) after pumping that well at 2,000 gpm for 180 days (fig. 3), (2) the hydraulic interference caused by the proposed well pumping 2,000, 3,000, or 4,000 gpm (fig. 2), and (3) the depth to static water level (50 feet below land surface). The pumping level at the Fines well that would most likely meet the field conditions is about 185 feet below land surface after both wells pump 2,000 gpm for 180 days from the same aquifer zone. Other pumping levels are included to show the magnitude of drawdown that might be caused by increasing the amount pumped from the same aquifer zone by the proposed well. The approximate drawdowns for the Fines well are computed for one pumping season only, and are not intended to be projected as a trend over a long period of time. Also, the indicated drawdowns do not reflect any recharge that may take place during this time or the effect that other nearby discharging wells may have on the pumping level of the Fines well.

Reference

Ferris, J. G., Knoweles, D. B., Brown, R. H., and Stallman, R. W., 1962, Theory of aquifer tests: U.S. Geol. Survey Water-Supply Paper 1536-E, p. 92-98.

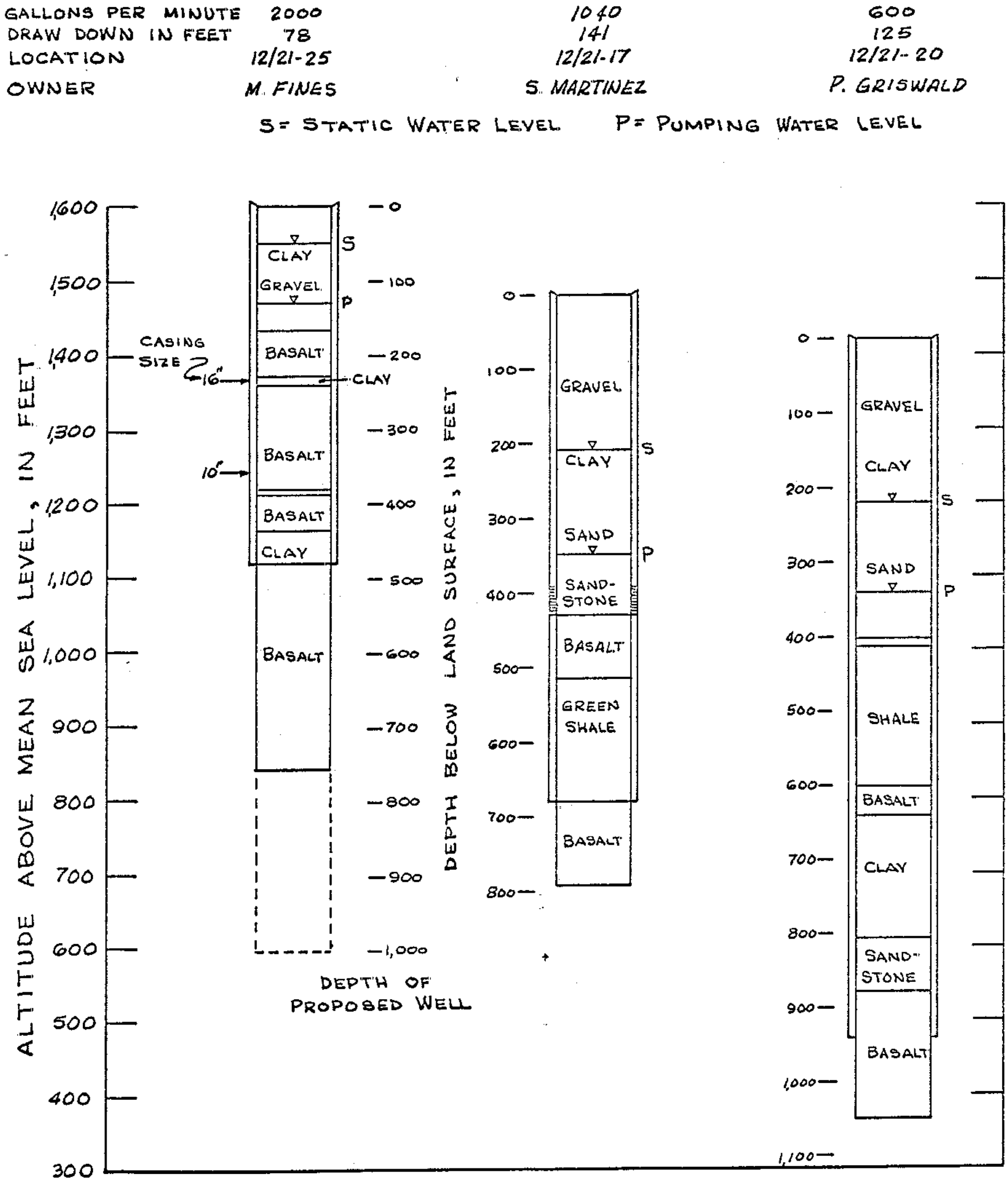

FIGURE 1.--Logs of wells.

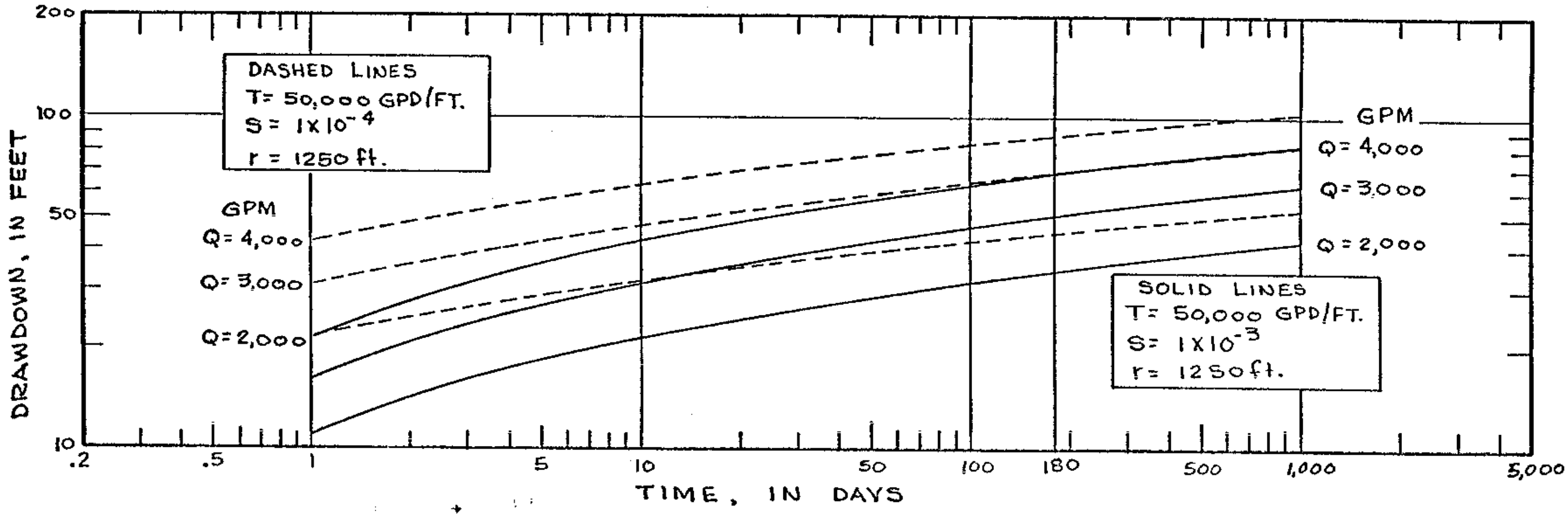

FIGURE 2.--Drawdown versus time.

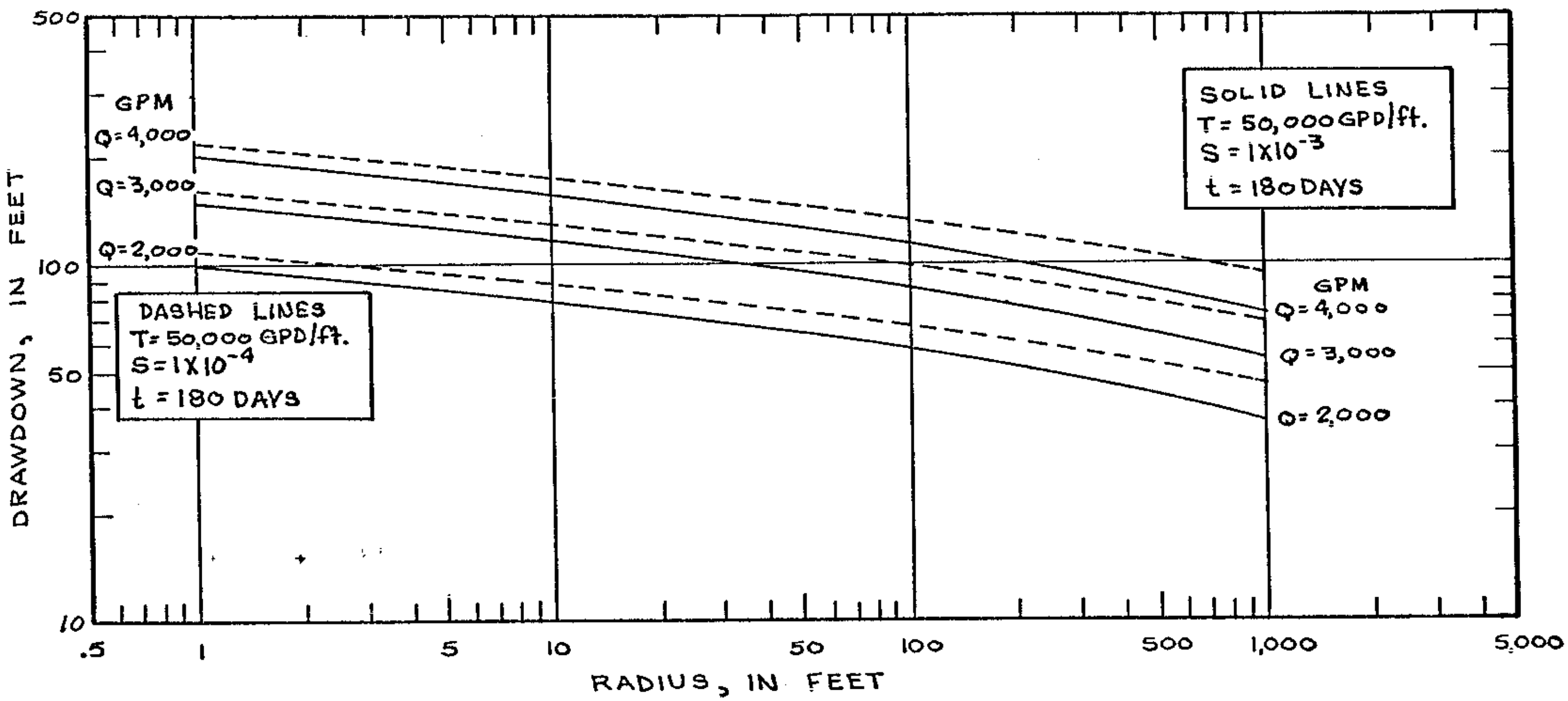

FIGURE 3.--Drawdown versus distance.

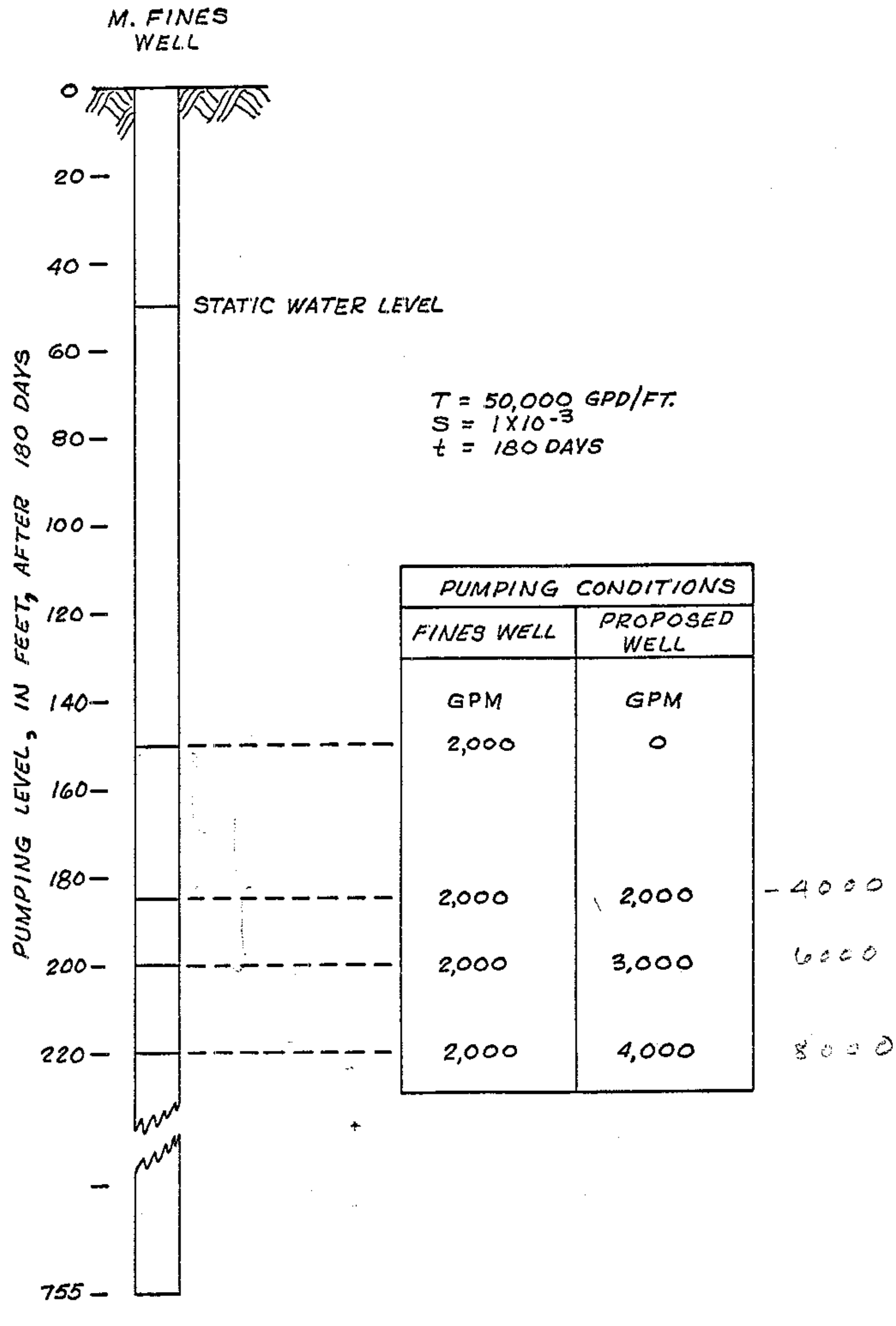

FIGURE 4.--Pumping level at the Fines well, including the estimated hydraulic interference from proposed well.

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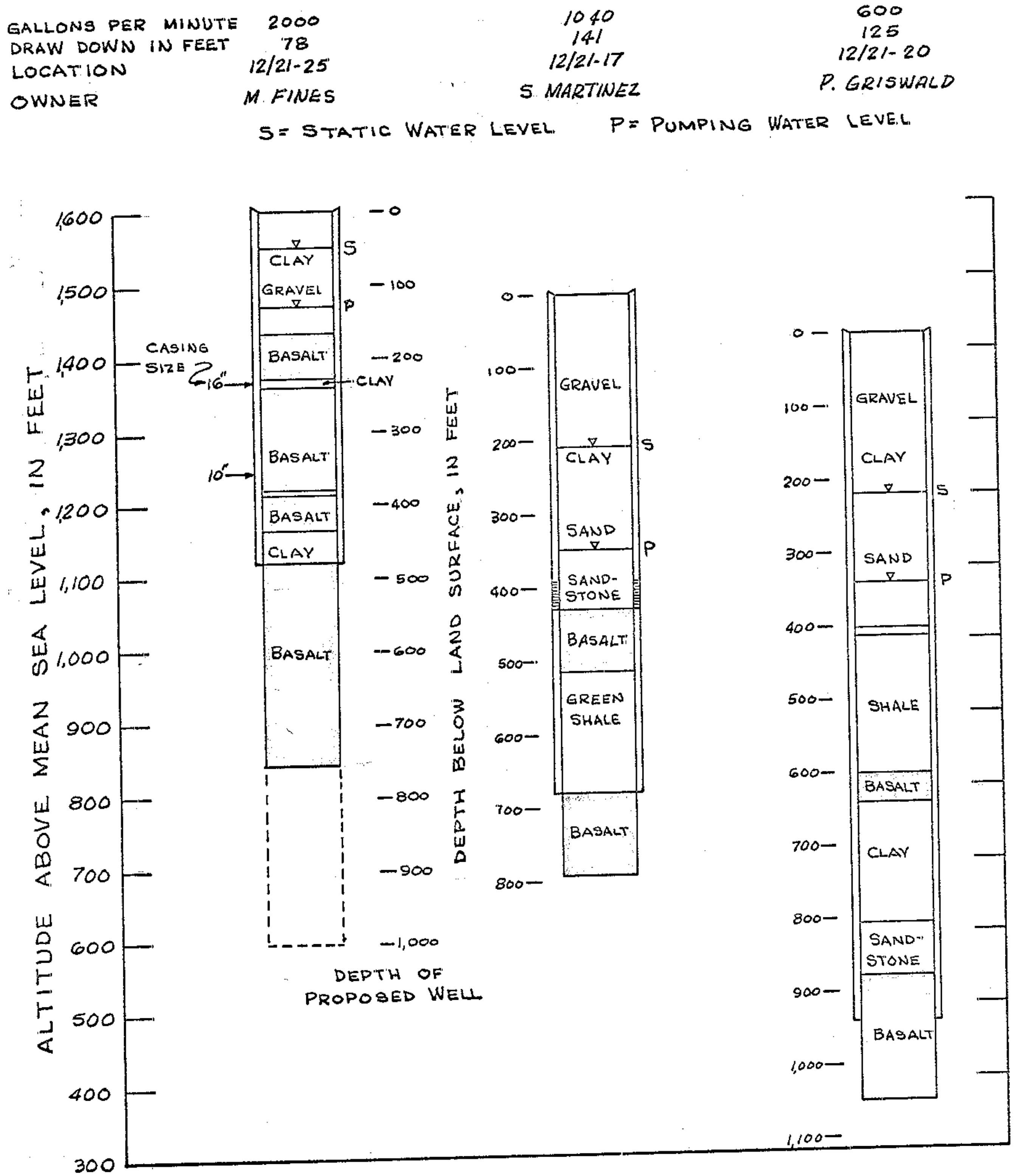

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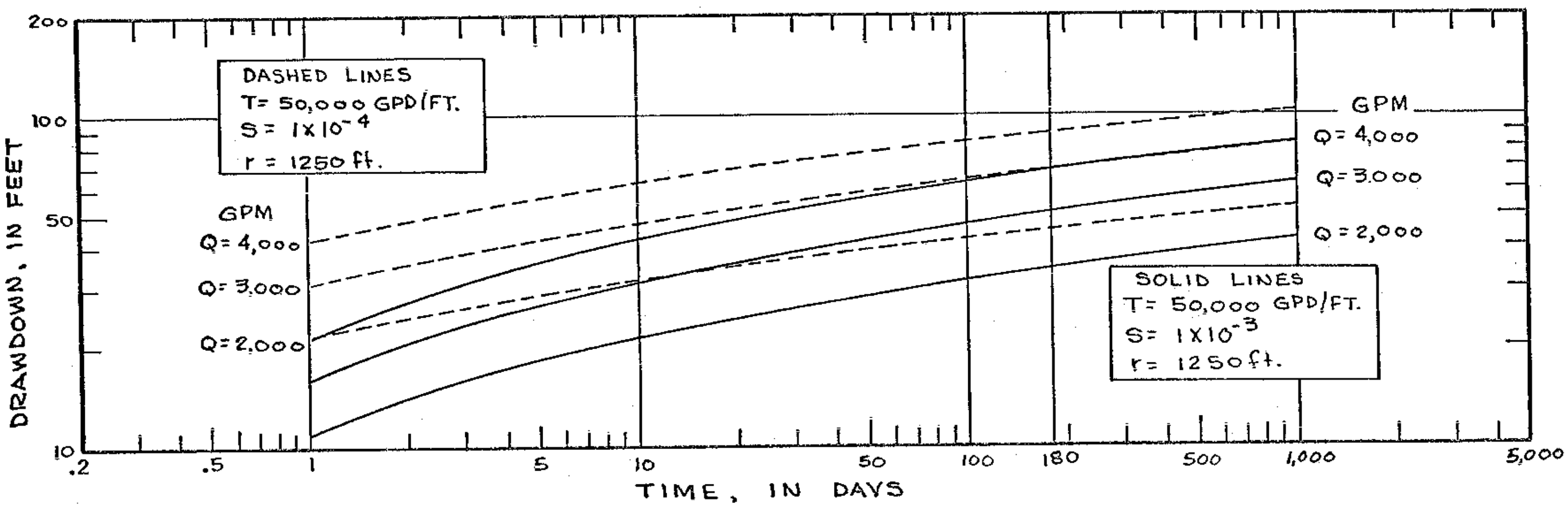

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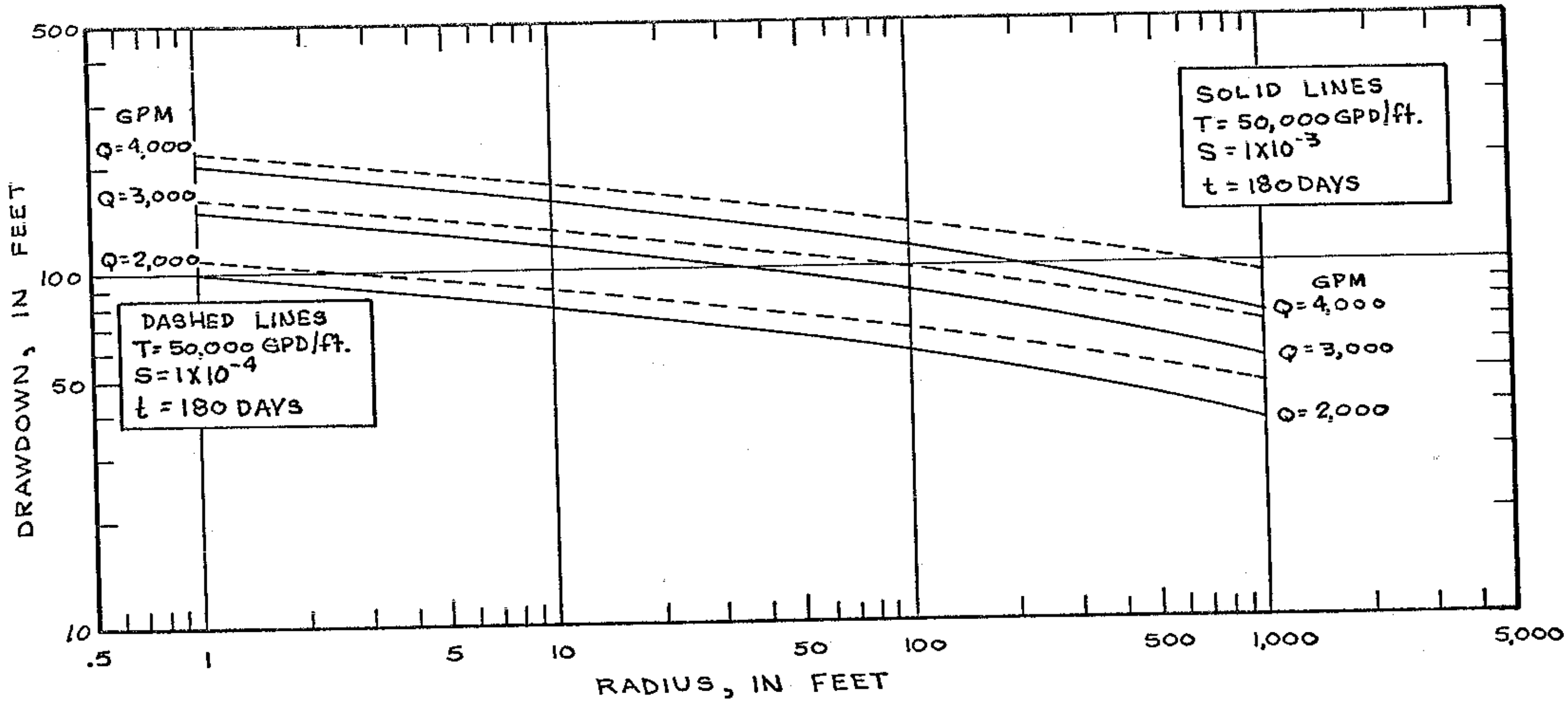

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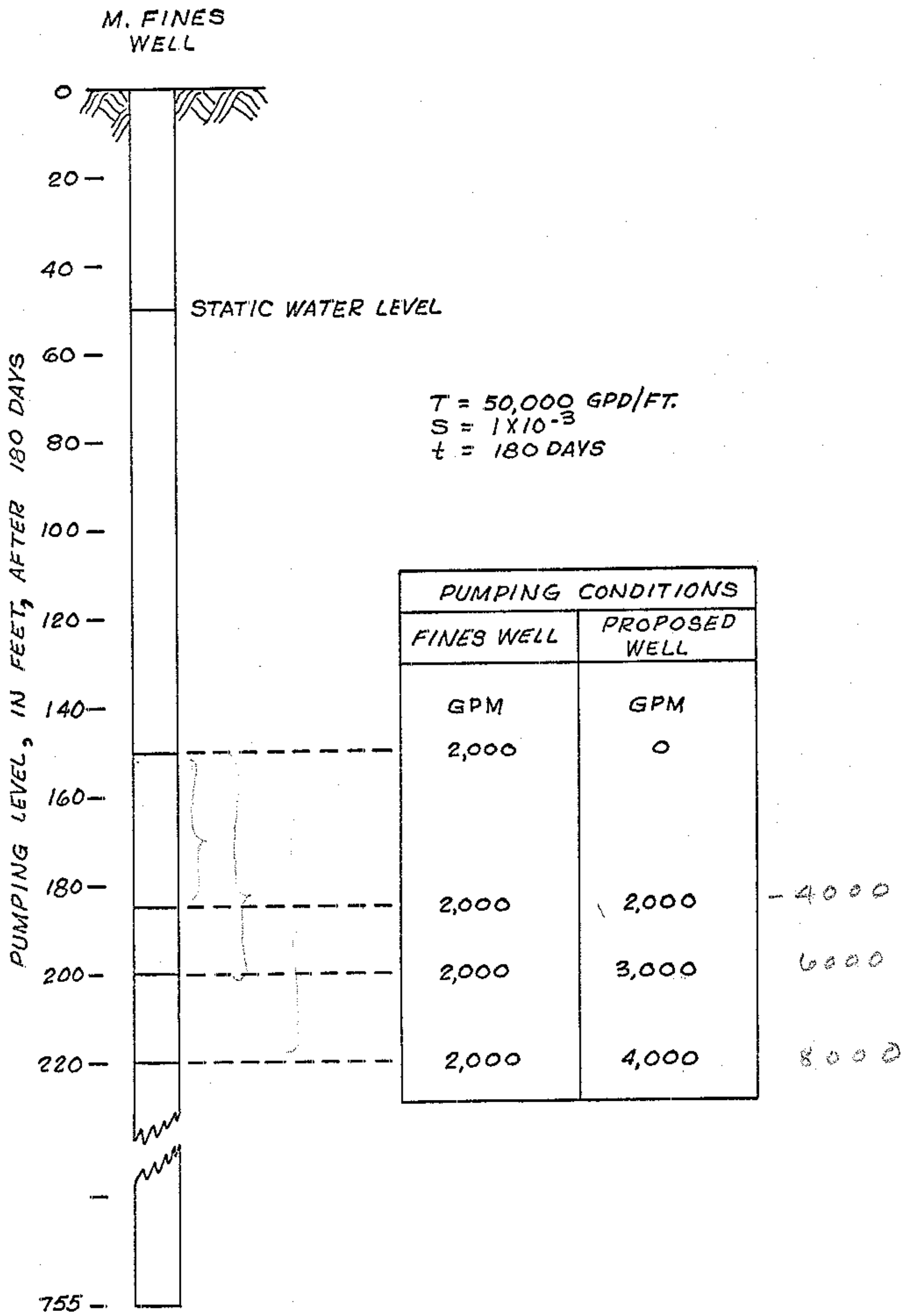

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