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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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MEMORANDUM ON PUMPING TESTS ON NEW PUBLIC-SUPPLY WELLS IN SALISBURY, MARYLAND

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**Prepared in cooperation with the
Maryland Department of Geology, Mines and Water Resources**

Approved 7/27/49 for open file & release to City Engineer of Salisbury.

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CONTENTS

ILLUSTRATIONS

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Introduction

A ground-water investigation was made in the Salisbury area, from June 1947 to June 1948, in cooperation with the Maryland Department of Geology, Mines and Water Resources. The City of Salisbury provided a part of the cooperative funds used for these studies. In June 1948 a preliminary report on the occurrence of ground water in the Salisbury area was released. The purpose of this memorandum is to briefly describe and present the results of pumping tests made subsequent to the release of the preliminary report.

Pumping tests were made in January and March 1949 on two new wells drilled to augment the public water supply of Salisbury, Maryland. These two wells, which extend the public supply well field 1,000 feet to the east, are situated about 50 feet north of Beaverdam Creek and are spaced 500 and 1,000 feet, respectively, from the nearest public-supply production well in the City Park well field.

The purpose of these tests was to determine the hydrologic properties of the aquifer and the maximum efficient yield of each well. To determine the hydrologic properties of the aquifer, four observation wells, 20 to 29 feet deep, were installed near each well tested. The coefficients of transmissibility and storage computed from the water-level fluctuations in these observation wells are not considered to be characteristic of the aquifer as the wells penetrated only the upper part of the zone of saturation. The maximum efficient yield of each production well was determined by periodically increasing the discharge and measuring the effect of each increase on the water level in the well.

Test on New Well 6

Well 6, which is 500 feet east of the nearest producing well, is 22 inches in diameter (O.D.) and screened from 33 feet to the base of the aquifer at 46 feet.

On January 13, 1949, well 6 was pumped with a portable gasoline suction pump at a rate of 40 g.p.m., the capacity of the pump. After this test was completed the observation wells were removed.

In March, a 1,000-g.p.m. turbine test pump was installed in well 6 and measurements were made of the effect on the water level in the well caused by changes in the amount of discharge. The well was pumped for about 25 minutes at each different rate of discharge. The rate of discharge was changed nine times and ranged from 310 to 535 g.p.m. The pumping level ranged from 22.5 to 42 feet below the top of the casing. (See fig. 1.) The specific capacity (g.p.m./foot of drawdown) of the well decreased as the discharge increased and ranged from 19 to 15 g.p.m. for each foot of drawdown. (See fig. 2.)

Test on New Well 7

Well 7, which is 500 feet east of well 6, is 22 inches in diameter (O.D.) and is screened from 33 feet to the base of the aquifer at 61 feet.

Five observation wells were installed near well 7. One well, P1, was installed inside the gravel pack 1 foot from the screen of well 7.

On March 17, well 7 was pumped with the 1,000-g.p.m. test pump and the decline of the water levels was measured. The well was pumped 4 hours at a rate of 515 g.p.m., after which the rate of pumping was increased about every 60 minutes until a discharge of about 750 g.p.m. was reached. At a discharge of 750 g.p.m. the pumping level was below the top stage of the pump, and air leaking into the pump prevented pumping the well at a higher rate. The well was pumped at about 750 g.p.m. for a period of about 4 hours. The pumping level in well 7 ranged from 31 feet to 48 feet. (See fig. 3.) The specific capacity decreased as the discharge increased and ranged from 20 to 18 g.p.m. for each foot of drawdown. (See fig. 4.) The difference in the altitude of the water level in the gravel pack around the screen, as measured in well P1, from that inside the well, at different rates of pumping, is shown in figure 5.

General Water-Level Conditions During Test

During the period in which the tests were made the water table within the well-field area was lower than normal. The height of the water table is affected by the level of the water in the stream running through the well field, and, as the water level of the stream had been lowered about 2 feet by removing the gates of the two dams in the well-field area, the water table was about 2 feet below normal. When these gates are replaced the ground-water levels in the vicinity of the well field will again rise to about their normal position.

Conclusions

New well 7.--The curve in figure 3, showing the pumping level at different rates of discharge, shows an increased downward trend at about 650 to 700 g.p.m. Figure 5 shows the difference in altitude between the water level in pumped well 7 and the water level in well P1, situated in the gravel pack about 1 foot from the screen, at different rates of discharge. These values should form a straight line if no turbulent flow were produced by high velocities in and around the screen. As these values do form a curve with an increasing slope with increased rates of pumping, it would seem that a sizable part of the drawdown in well 7, the pumped well, is due to loss of head in the gravel pack and through the screen. The sharp break in the specific-capacity curve (fig. 4) also shows the effect of well losses at discharge rates of more than 650 to 700 g.p.m.

The above data indicate that at a rate of discharge of over 650 to 700 g.p.m. the efficiency of the well decreases rapidly.

New well 6.—The specific-capacity curve of well 6, shown in figure 2, does not show as sharp a break as the same curve for well 7. In general the curve shows a progressive decrease in specific capacity with increased rates of pumping; however, there is a slightly increased downward trend at discharge rates of 475 g.p.m. and over. The curve in figure 1, showing the pumping level in well 6 at different rates of discharge, also shows a slight break at about 450 to 475 g.p.m. A well was not installed in the gravel pack around well 6, so data similar to those on well 7 could not be obtained.

It appears from the results of this pumping test that the maximum efficient yield of well 6 is about 450 to 475 g.p.m.

Long-term yields of wells:—There are several factors that may increase or decrease the yield of wells 6 and 7.

As the wells are pumped they may become more fully developed (fine material may be pumped out), so that the yield at a given pumping level may increase. It was evident during the pumping tests made on the wells in March that the wells were more fully developed at the end than at the beginning of the tests. When the gates are replaced in the dams on Beaverdam Creek the resulting rise in ground-water levels in the well field will increase the yields of the wells. During the summer months a slight increase in yield may result from the increase in temperature of the ground water.

A decrease in yield may be caused by the lowering of the water level caused by pumping the wells over a longer period of time than they were pumped during these tests, or by a lowering of the water table within the area of influence caused by a period of low precipitation.

It would be desirable to install the permanent pumps in such a way that water levels in the wells can be measured periodically. Also, well P1 in the gravel pack of well 7 should be left available for water-level measurements. A record of the difference in altitude between the pumping level in well 7 and the water level in the gravel pack, measured in observation well P1, will be of value in the future in determining the cause of any decrease in the yield of well 7.

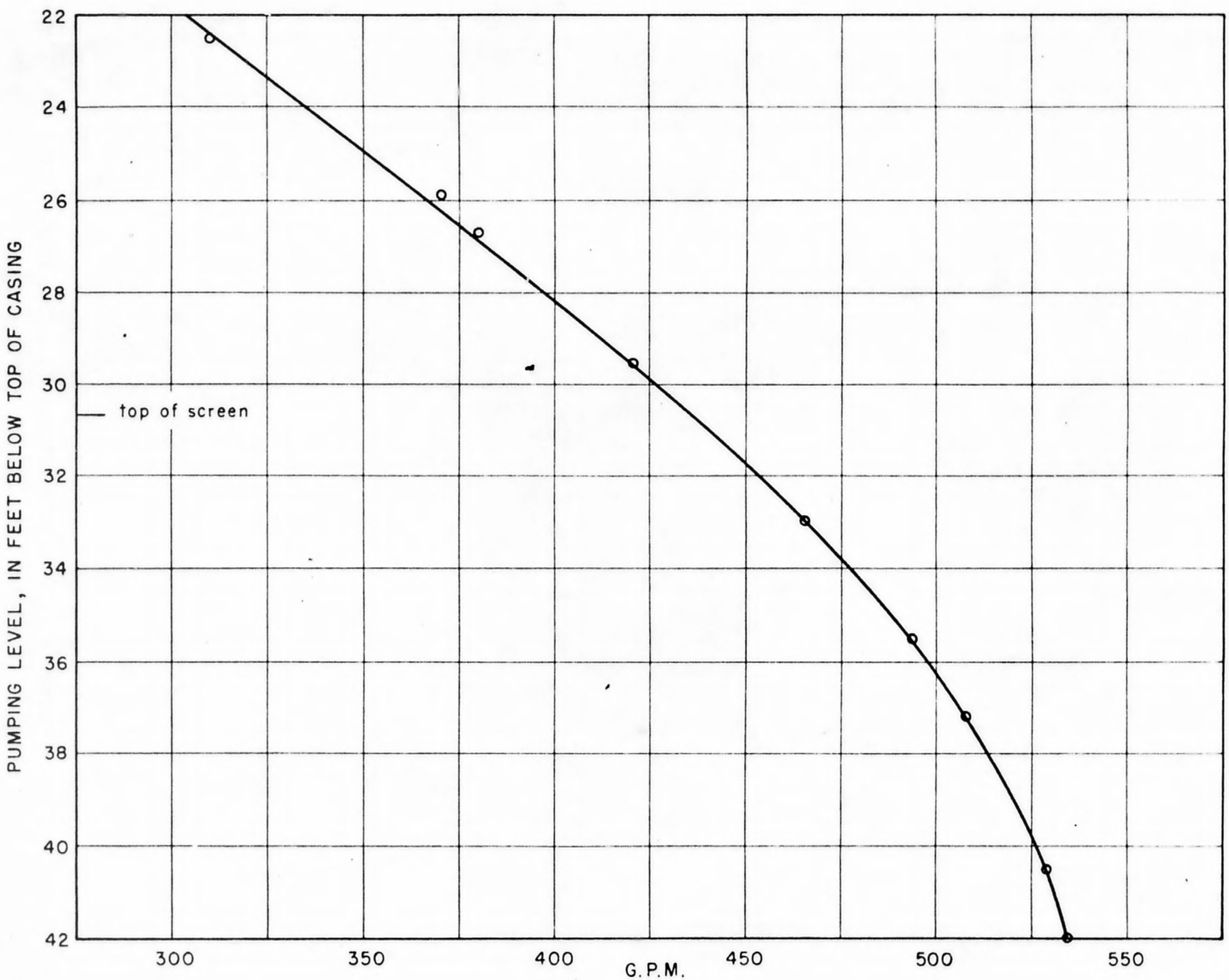

FIGURE I. GRAPH SHOWING RELATION OF YIELD OF WELL 6 TO PUMPING LEVEL

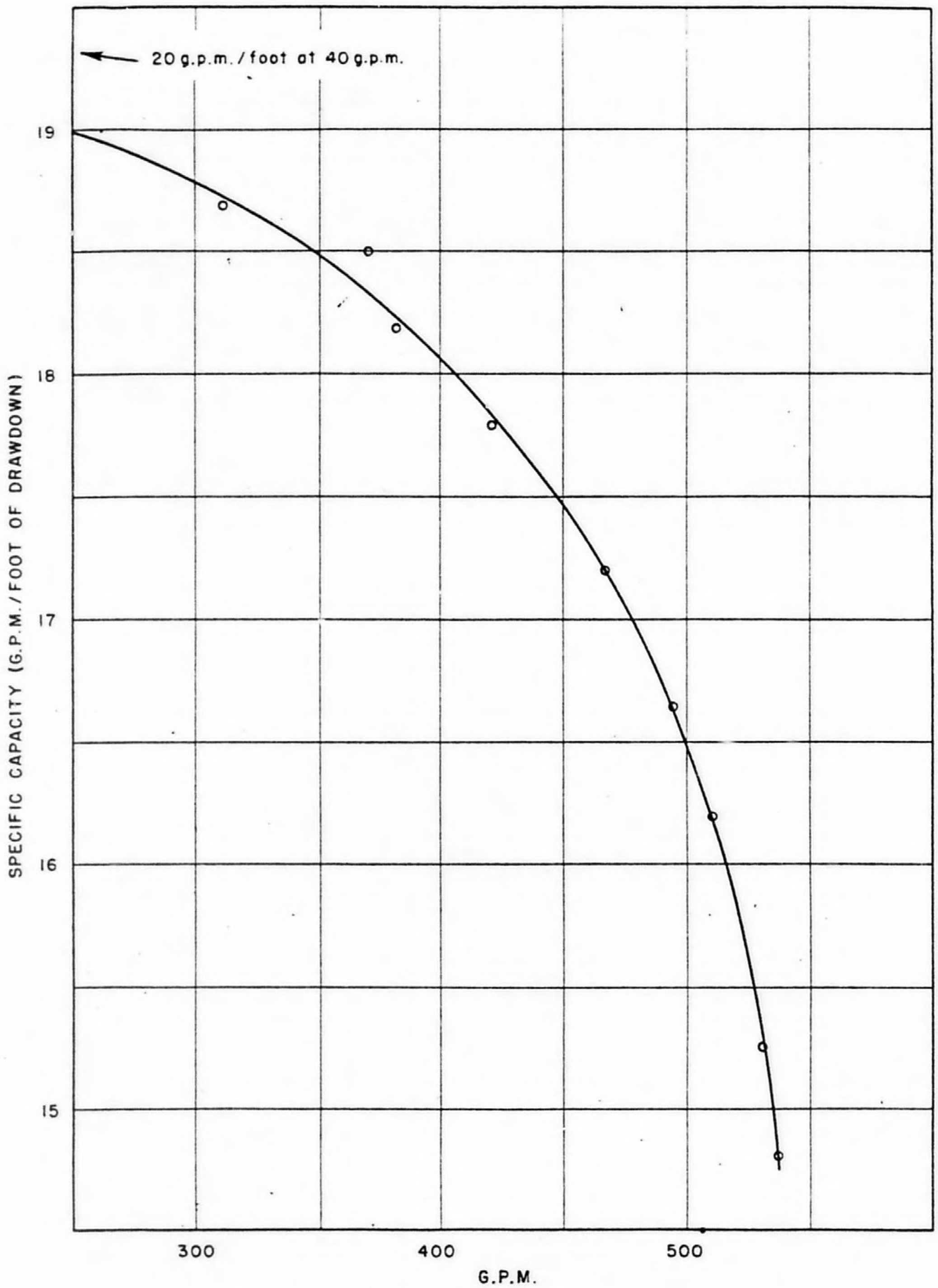

FIGURE 2. SPECIFIC- CAPACITY CURVE OF WELL 6

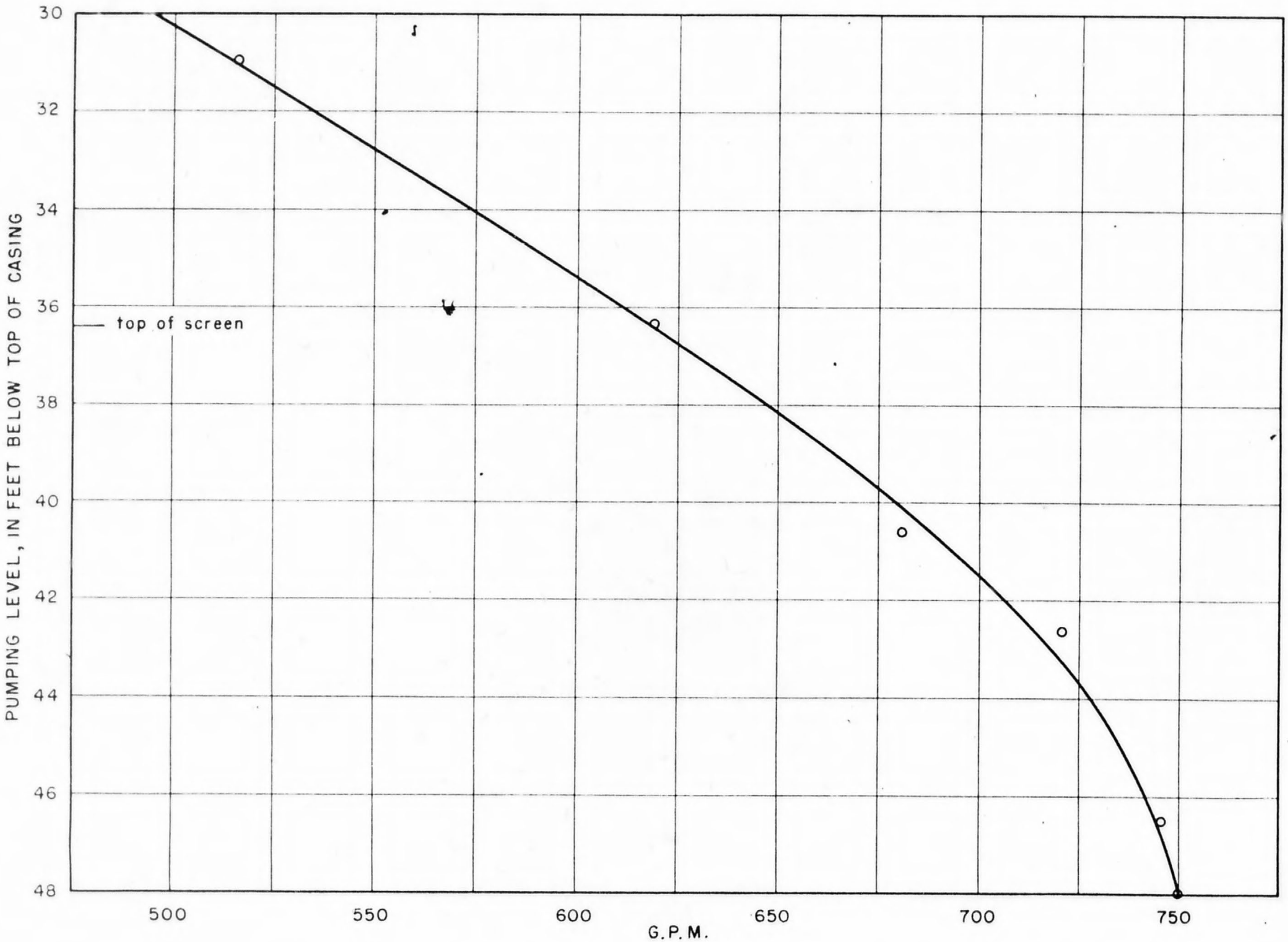

FIGURE 3. GRAPH SHOWING RELATION OF YIELD OF WELL 7 TO PUMPING LEVEL

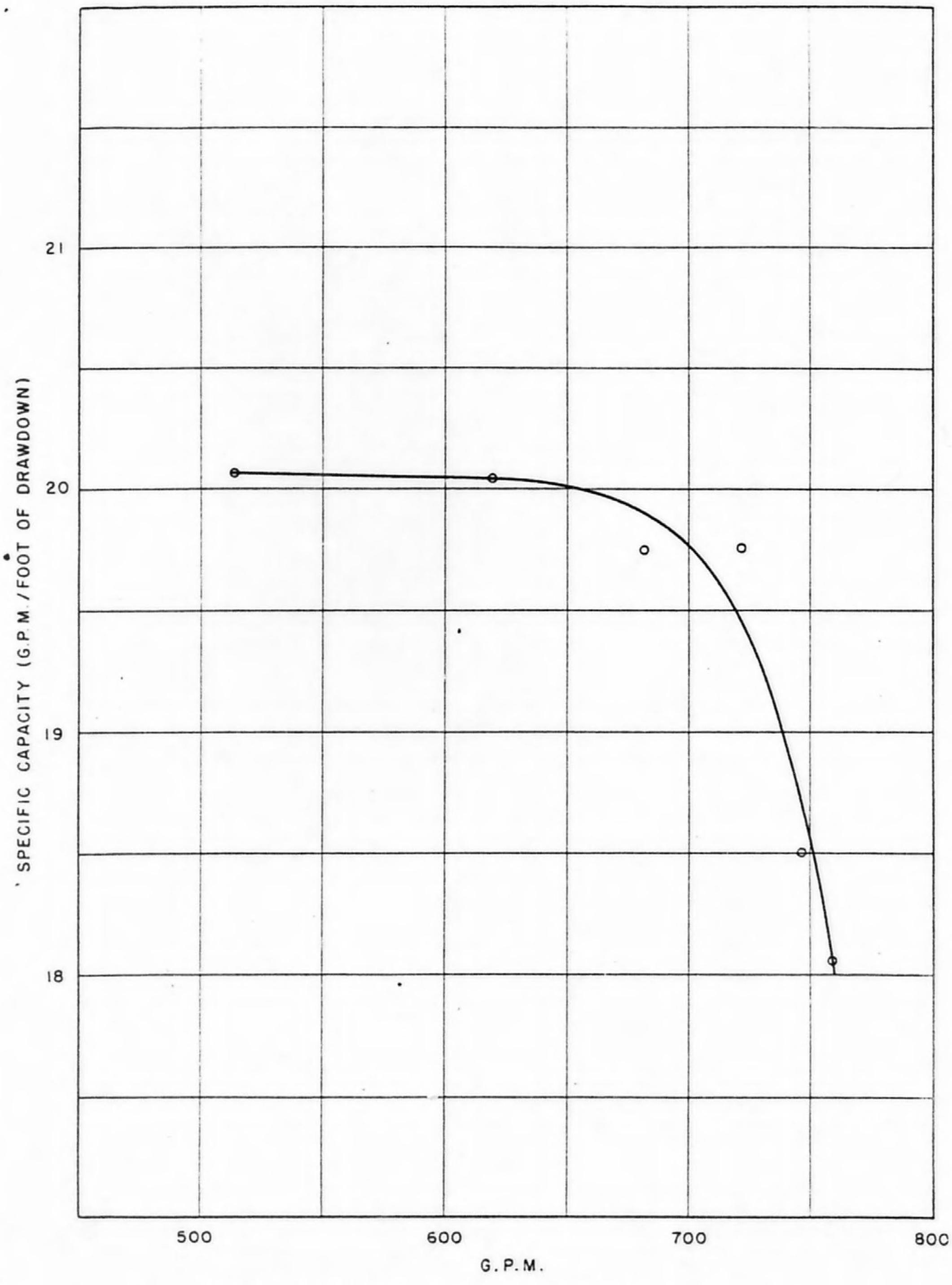

FIGURE 4. SPECIFIC-CAPACITY CURVE OF WELL 7

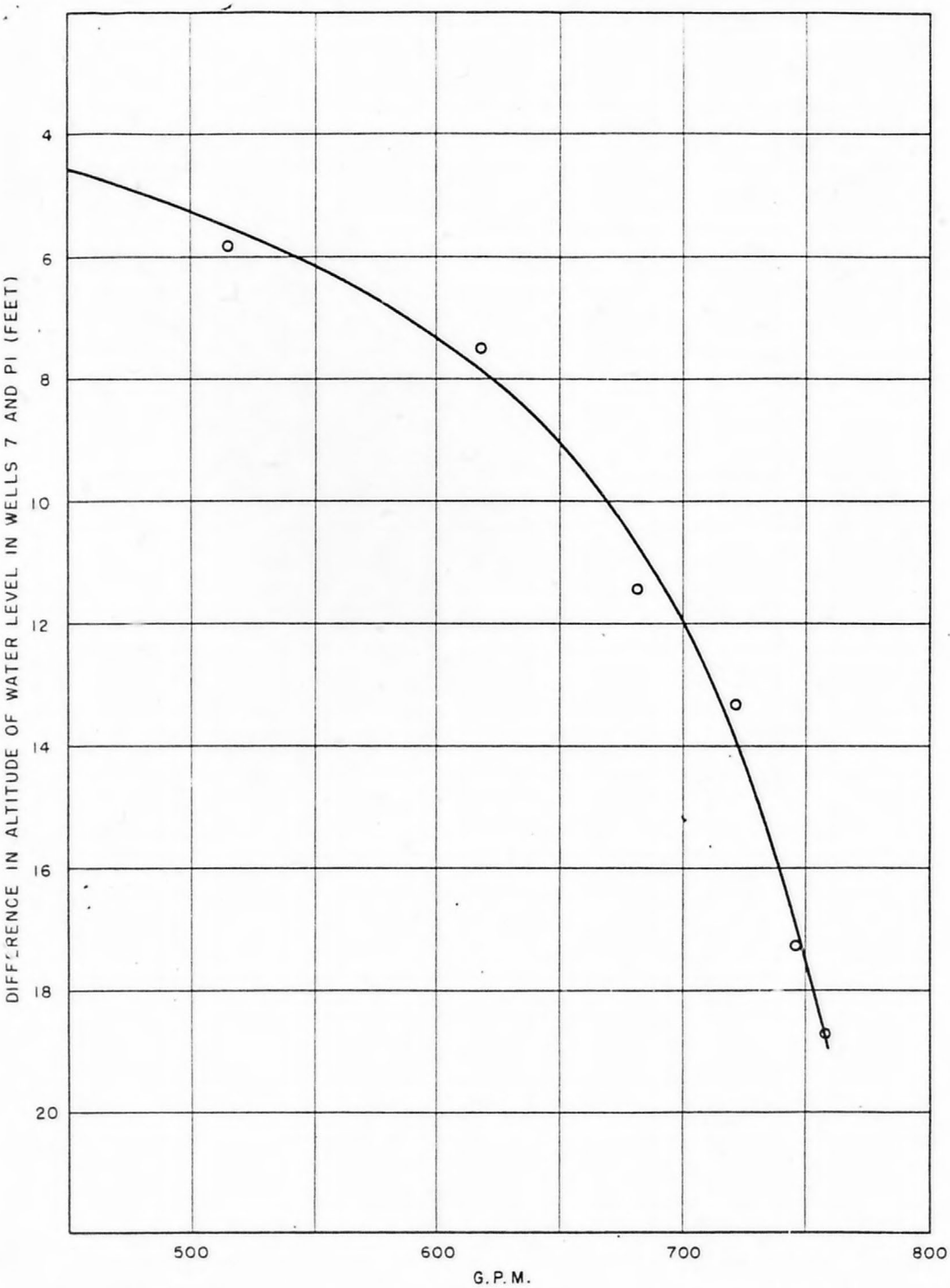

FIGURE 5. GRAPH SHOWING DIFFERENCE IN ALTITUDE OF WATER LEVELS IN WELL 7 AND ADJACENT WELL PI AND RELATION TO YIELD