DECLINING WATER LEVELS
IN THE
PERCHED AQUIFER SYSTEM,
SOUTHWEST MOUNTAIN HOME

by

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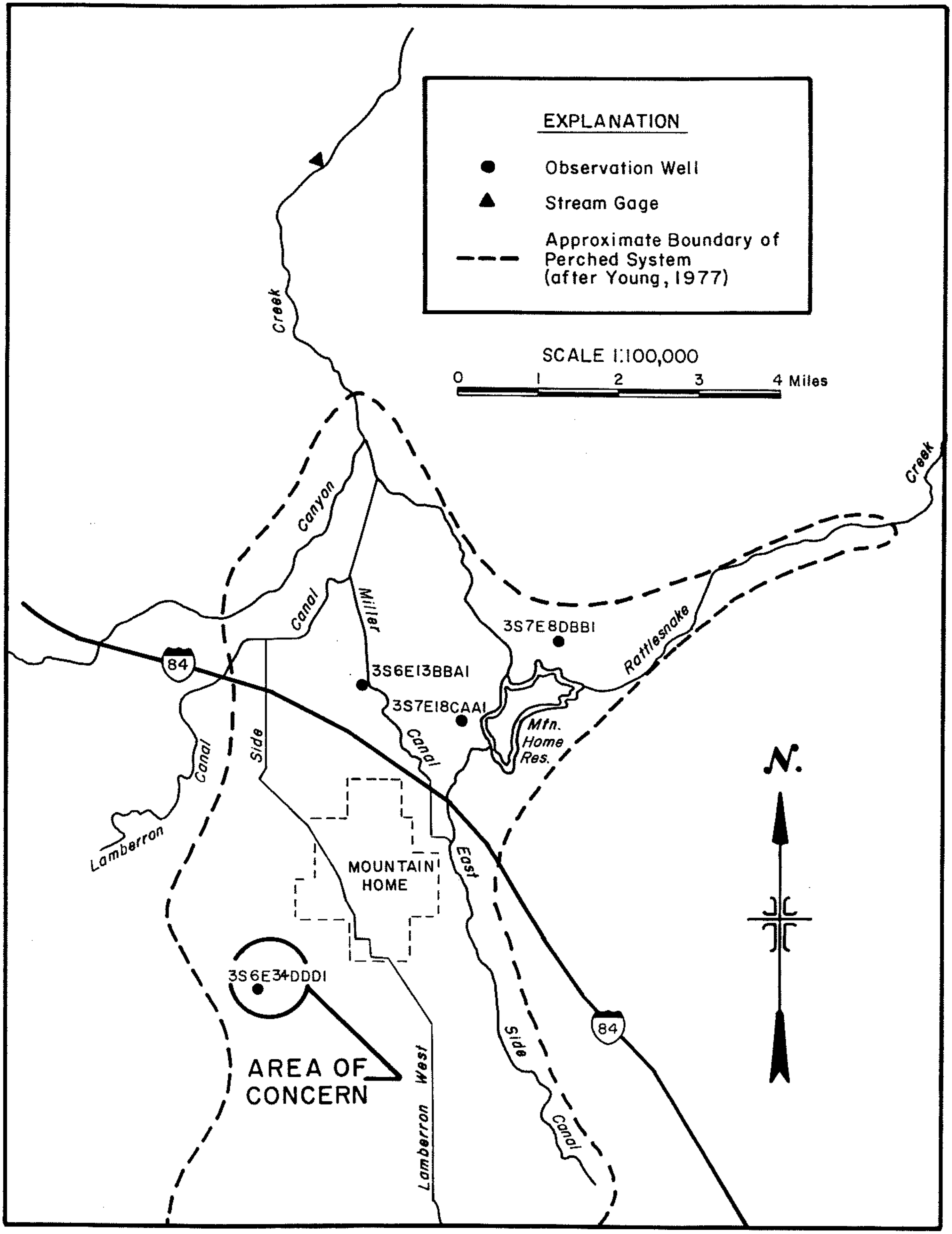
INTRODUCTION

Several residents that live about a mile southwest of Mountain Home have expressed concern over declining water levels in their shallow wells (outlined in Figure 1). Many of the well owners have had to have their wells deepened or new wells drilled because water levels have apparently dropped enough to cause their shallow wells to go dry. To assess the cause and nature of this local problem, the Idaho Department of Water Resources (IDWR) undertook a reconnaissance level study to evaluate the available data on the area.

Three major factors that solely or collectively are most likely responsible for the declining water levels have been reviewed. One entailed assessing the effects of reduced recharge to the aquifer system because of consecutive years (1987-88) of significantly below normal precipitation. Another involved determining whether over-development has occurred with a limited ground-water resource (withdrawal exceeding the mean annual recharge). The last required assessing the potential effects of well construction practices that have been used in the area. This report states the findings that were developed during this preliminary review.

Figure 1. INDEX MAP OF MOUNTAIN HOME AREA



HYDROLOGICAL REGIME

Ground water in the Mountain Home area occurs in both shallow perched water-bearing zones and a deeper regional system. The approximate extent of the perched system, as inferred by Young (1977), is shown on Figure 1. What was once a more restricted or even non-existent resource, the perched system has grown with the advent of surface water irrigation. The spreading of surface water over a greater amount of land area through canals, laterals, and the Mountain Home Reservoir has provided the primary source of recharge to the perched system. Recharge to the underlying regional system occurs through vertical leakage from the perched system and deep percolation of precipitation in the higher elevations.

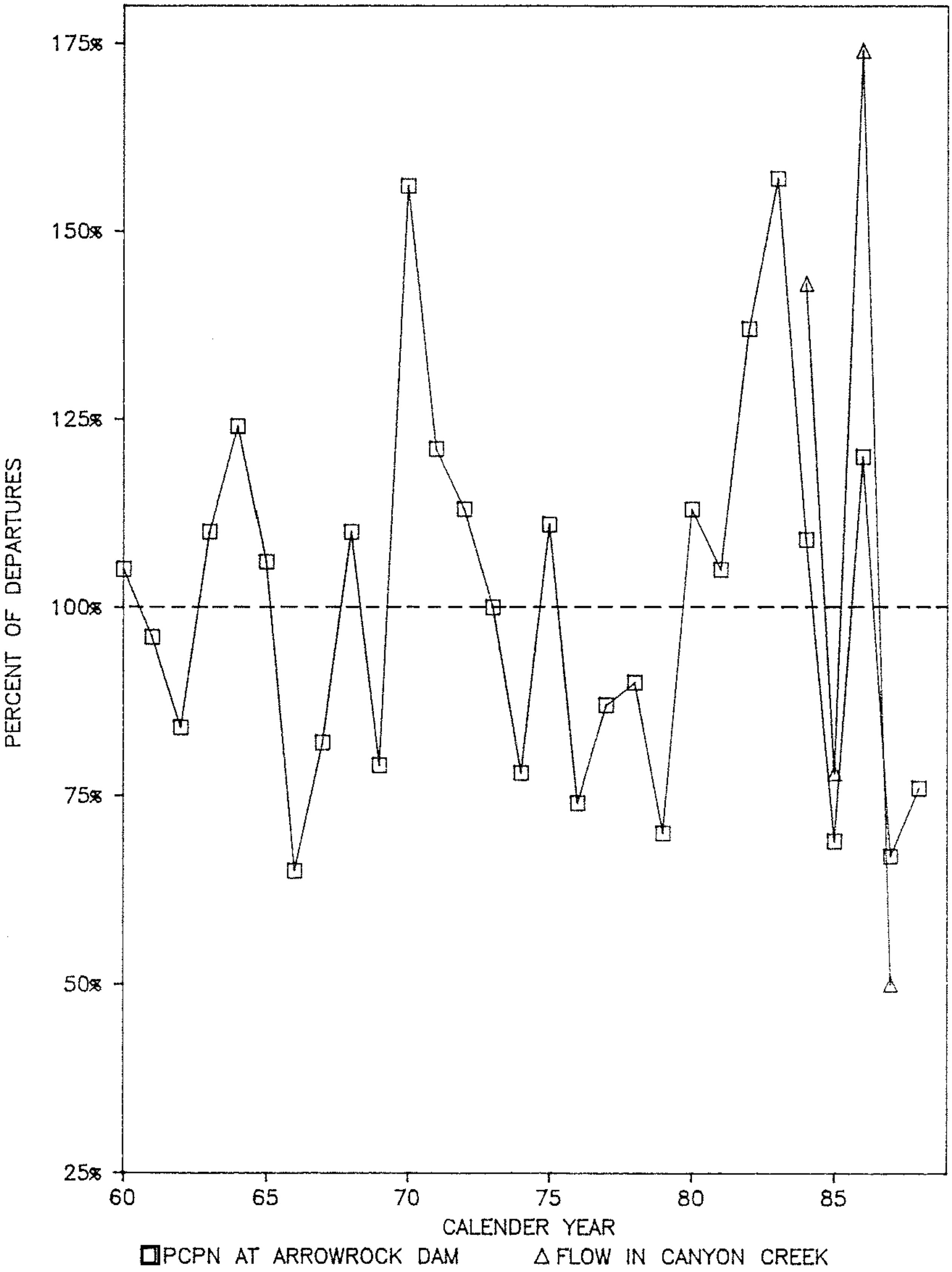
The rocks and sediments that compose the perched water-bearing zones vary substantially over the areal extent of the perched system. The rubbly contacts between the extensive lava flows that underlie the area, along with the joint openings within the individual lava flows, provide the primary avenues for ground water to move. Silt, sand and gravel layers that overlie and intertongue with the basalt flows also transmit ground water through the pores between the sediment grains. Due to the substantial differences between the horizontal and vertical hydraulic properties of the saturated material, the flow of ground water is predominantly lateral prior to its ultimate descent to the regional system. This anisotropic nature of the perched system is to a large degree the cause of its existence and its present areal extent.

VARIATIONS IN ANNUAL RECHARGE

Changes in the annual rate of recharge to the perched system is directly related to annual inflow of surface water into the Mountain Home area. Most surface water inflow into the area occurs from Canyon and Rattlesnake Creeks. Natural flow in Canyon Creek is augmented and in part regulated by an intermountain diversion from Little Camas Reservoir. Norton et al. (1982) estimated the mean total annual flow in Canyon Creek (natural and imported) at 28,500 acre feet. In March, 1984, the U. S. Geological Survey (USGS) installed a stream gage on Canyon Creek (shown on Figure 1) and began measuring daily flow in the creek. Early miscellaneous measurements on stream flows in Canyon Creek were performed by the IDWR and the USGS.

The graph on Figure 2 shows the percentages of departures of measured total annual flows in Canyon Creek from the mean total annual flow. Because of the short period of record at Canyon Creek and the need to understand the long-term trends in stream flow, the percentages of departures of measured total annual precipitation were included on the graph. A definite correlation between stream flow in Canyon Creek and precipitation exists for

Figure 2. PERCENT DEPARTURE FROM MEAN ANNUAL



the period of 1984-87, although the peaks and troughs in the stream flow data are of greater amplitudes.

WATER LEVEL FLUCTUATIONS

Water levels in four wells that are completed in the perched system have been measured during the past several years. Three of the wells are measured by the IDWR bi-annually, while the remaining well is measured by the USGS every other month. The locations of the wells are shown on Figure 1. Hydrographs of each of the wells for their respective period of record are shown on Figures 3 - 6. Variations in water level trends between each of the wells are most likely the result of a combination of the following factors: (1) the relative proximity of the well to local sources of recharge (such as streams, canals, laterals, and the Mountain Home Reservoir); (2) the amount of local recharge entering the perched system; (3) differences in the hydraulic properties of the water-bearing materials present; (4) the amount of ground water pumped locally; (5) the amount of vertical leakage from the perched to the regional systems.

Water level trends in all the observation wells roughly correlate with trends in precipitation and flows in Canyon Creek that are shown on Figure 2. During the late 1970's, when precipitation was consistently below average, water levels were progressively declining (as is apparent for Well 3S-6E-13BBA1, Figure 6). By the early 1980's, precipitation was generally above average and a rise in water levels reflects this relative

Figure 3. Hydrograph of Well 3S 06E 34DDD1

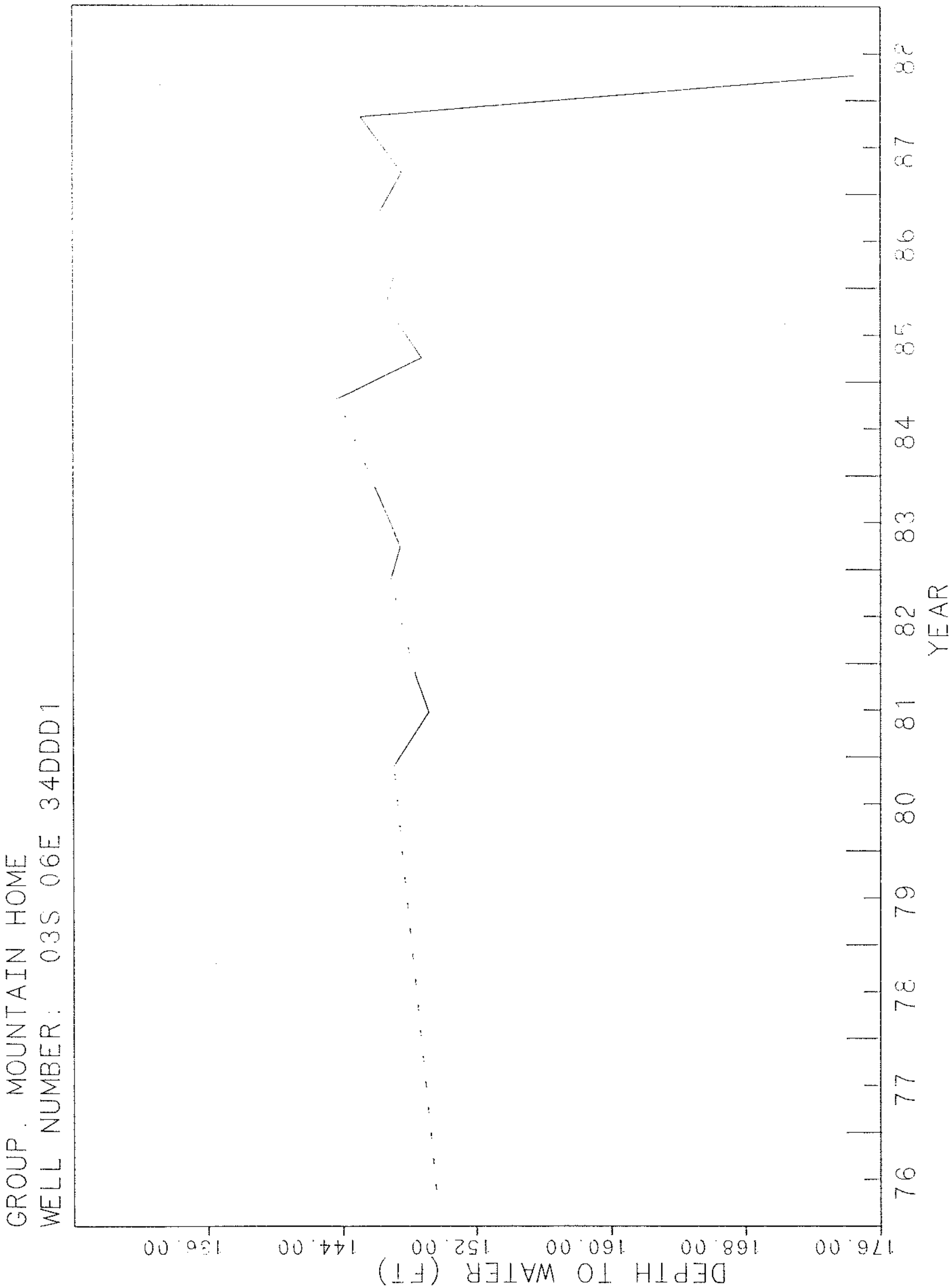


Figure 4. Hydrograph of Well 3S 7E 18CAA1

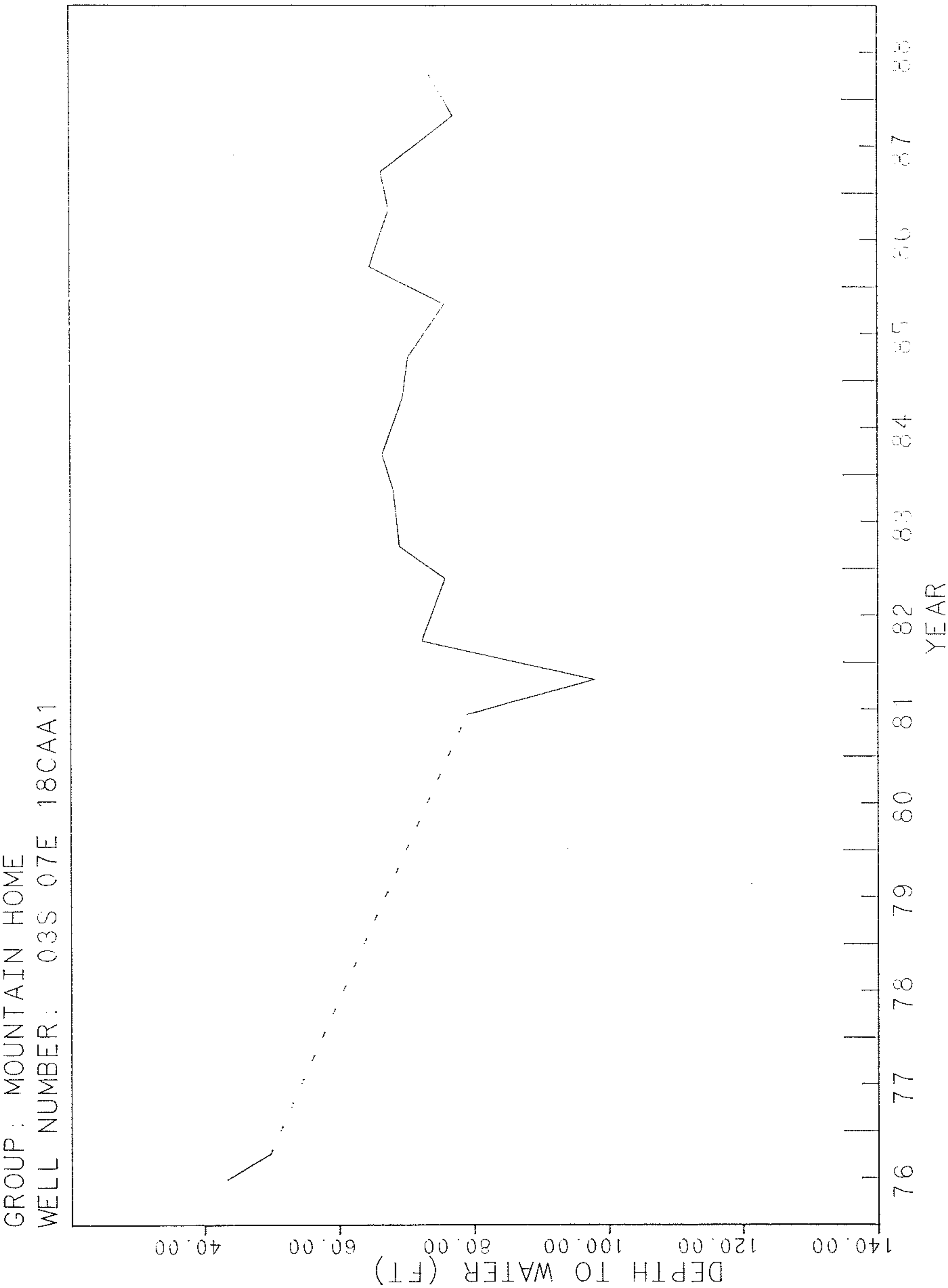


Figure 5. Hydrograph of Well 3S 7E 08DBB1

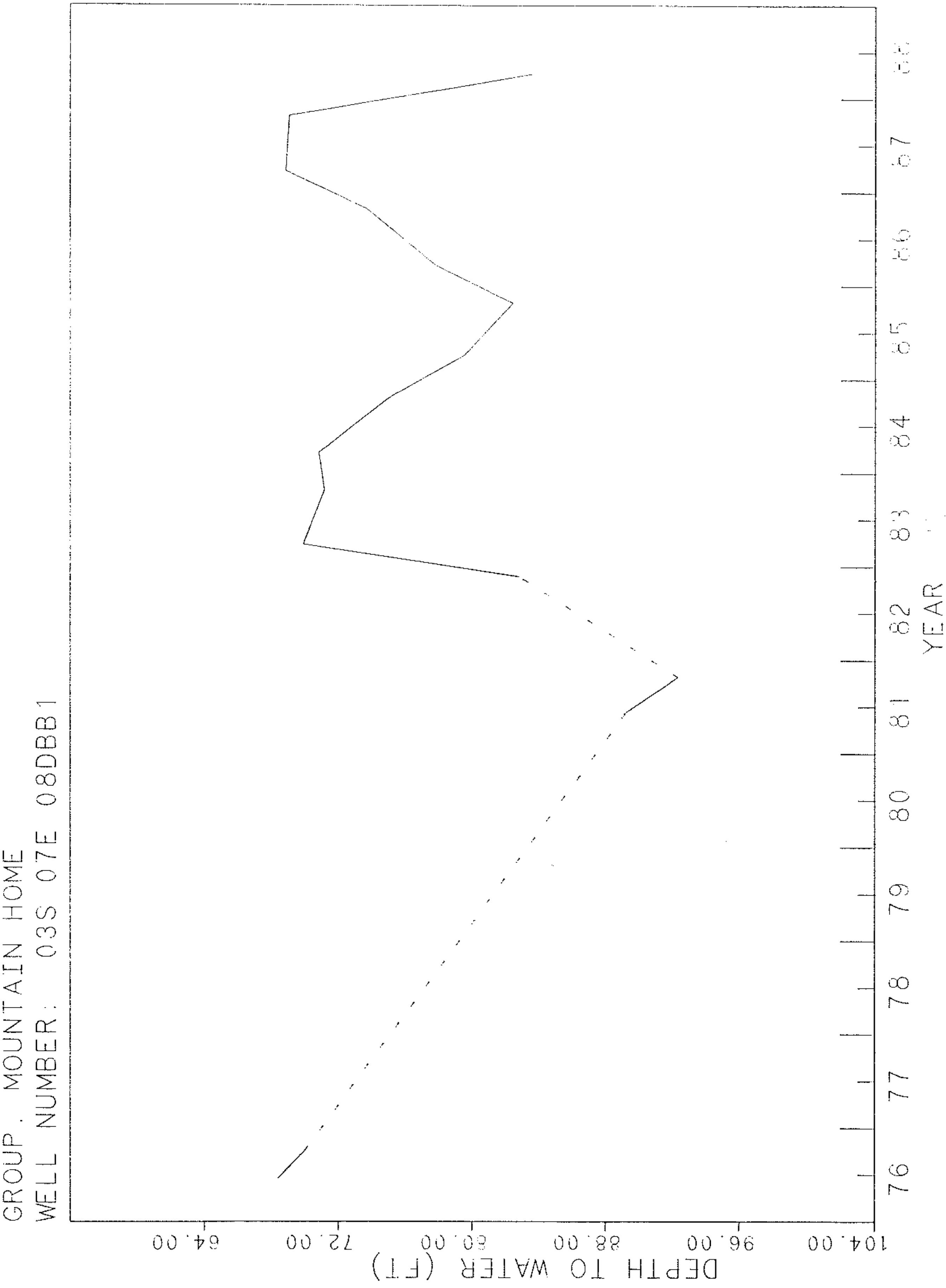
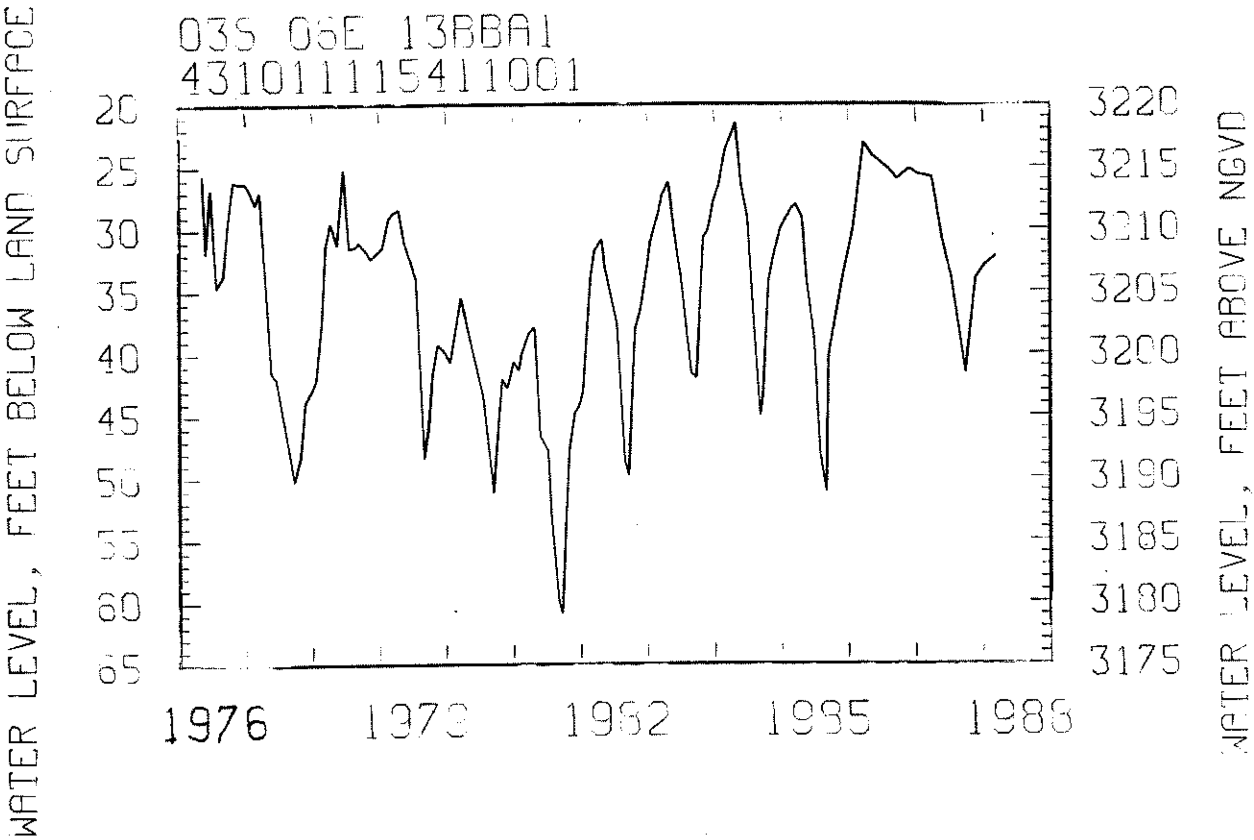


Figure 6. Hydrograph of Well 3S 6E 13BBA1



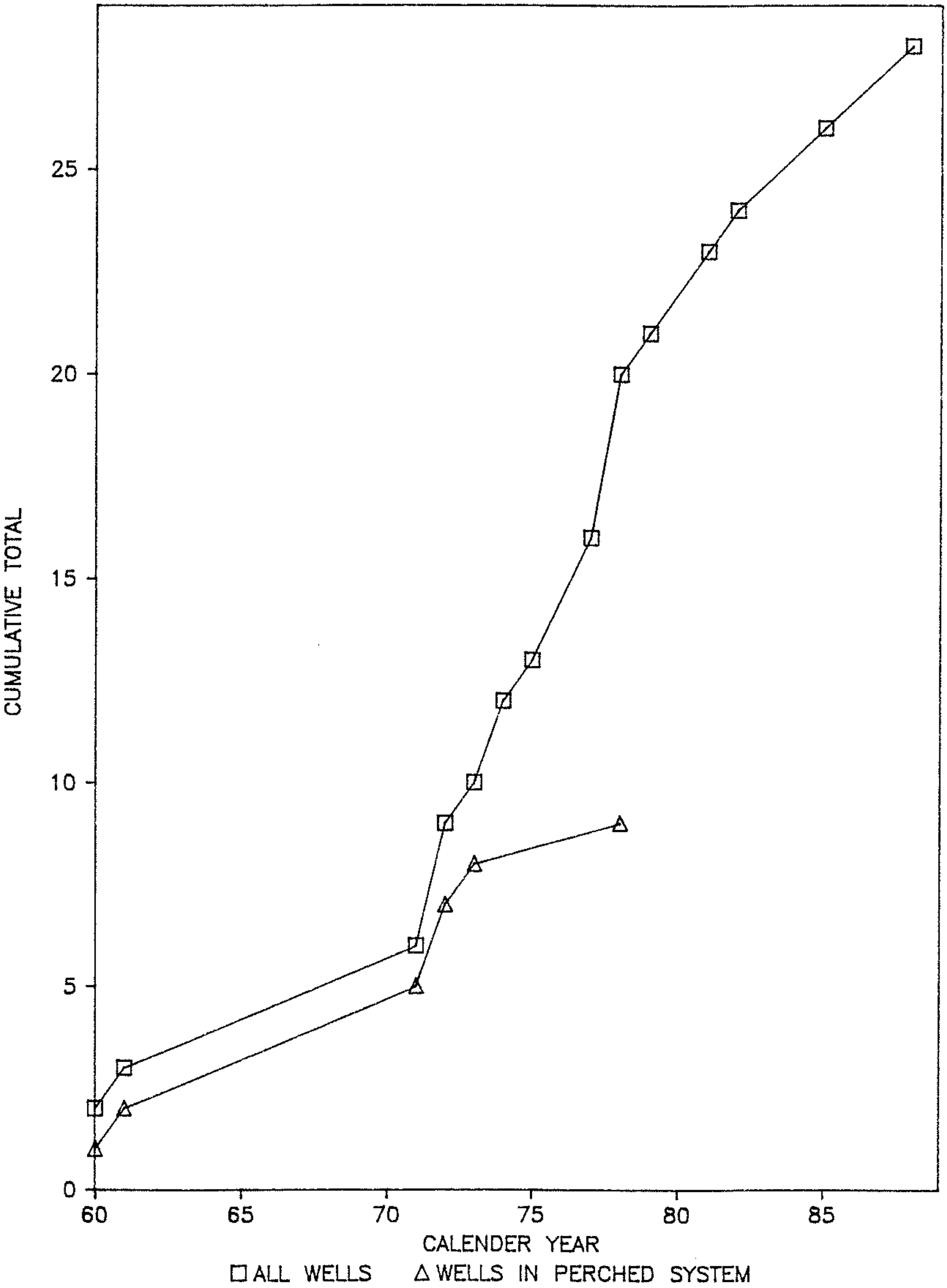
increase in recharge. The below average water year in 1985 resulted in a short-term decline in water levels. Beginning in 1987 and continuing into the current year, precipitation has been far below normal. Stream flow in Canyon Creek for 1987 was 50 percent of mean annual and is currently running way below normal for 1988.

Water levels measurements made this spring range from 6.3 to 26.8 feet below the previous spring measurements. Declines were greatest in the two observation wells closest to the inferred margin of the perched system (see Figure 1). Well 3S-6E-34DDD1, which occurs within the area of concern, indicated a decline of 26.8 feet and Well 3S-7E-8DBB1 showed a decline of 14.7 feet. The substantial decline observed at Well 3S-6E-34DDD1 may be in part due to a reduction in the amount of acreage irrigated by surface water locally and as a result an associated decline in a local source of recharge.

IMPACT OF LOCAL WELL DEVELOPMENT

According to the Well Driller's Reports that have been filed with the Department, there are a total of 28 wells that have been completed within the area of concern. Figure 7 shows the historic trend of well development in the area. Most of the wells were drilled for domestic uses, although some parcels of 5 acres or less are irrigated with ground water.

Figure 7. HISTORY OF WELL COMPLETION



The general practices of well construction in the area entail the setting of less than 50 feet of surface casing with the remainder of the well being completed open hole. This practice has probably been used because the wells were drilled into basalt and would remain open by themselves, therefore removing the need and the additional expense for casing. However, a drawback to this type of well completion is that communication between multiple water-bearing zones can occur. In regard to the local hydrogeology, this well construction practice has increased the avenues for downward flow to occur from the perched to the regional systems, and as a result, the amount of ground water leaving the perched system through vertical leakage has undoubtedly been increased.

By 1978, the ninth and last well on record was completed in the perched system within the area of concern (see Figure 7). At this same time, a total of 11 deep wells that were open to both the perched and regional system existed in the area. According to some shallow well owners, the low water years that occurred during this period caused water levels to decline, but not to the extent of wells going dry. This would suggest that the amount of ground water held in storage, along with the reduced recharge that was available, were enough to offset the amount of ground water leaving the perched system through pumpage and vertical leakage (natural and well construction induced). However, since no water level measurements are available for wells in the area, it is impossible to fully discern the actual impact this period of reduced recharge had on the local hydrologic system.

The circumstances that have caused the recent declines in water levels in the perched system differ to some degree from what occurred during the late 1970's. The present drought appears to be more severe due to the consecutive years (1987-88) of way below average precipitation versus the more staggered downward trends in precipitation that were observed in 1976 and 1979. Also, there has been 6 new deep wells drilled since 1978 in the area that are providing additional avenues for ground water to leave the perched system. Two deep wells that were drilled in 1988 have been excluded because one has an anomalously shallow water level, indicating that downward flow is not occurring, and the other was drilled just recently to obtain an alternate water supply after the individual's shallow well went dry.

CONCLUSIONS

The perched aquifer system appears to be a limited resource that is extremely sensitive to annual variations in recharge. This is especially pronounced in areas near the margin of the system and farther away from local sources of recharge, as in the area of concern. Well construction practices have undoubtably increased the amount of ground water leaving the perched system through vertical leakage. During periods of drought, this has put an additional stress on an already taxed resource.

Even though the perched system will most likely rebound from this current decline, water users that live near the margin of the system and are more distant from sources of recharge can obtain a more stable water supply from the deeper aquifer system (as several have done).

REFERENCES

Norton, M.A., W. Ondrechen, and J. L. Baggs, 1982, Ground Water Investigation of the Mountain Home Plateau, Idaho: Idaho Department of Water Resources Open-File Report, 62 p..

Ralston, D. R. and S. L. Chapman, 1968, Ground Water Resources in the Mountain Home Area, Elmore County, Idaho: Idaho Department of Water Resources Water Information Bulletin No. 4, 63 p..

Young, H. W., 1977, Reconnaissance of Ground Water Resources in the Mountain Home Plateau Area, Southwest Idaho: U. S. Geological Survey Water Resources Investigations 77-108, Open-File Report, 40 p..