# SUMMARY OF GROUND WATER CONDITIONS

# IN THE

# RAFT RIVER AREA


BY

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JULY, 1994

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BOISE, IDAHO

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## INTRODUCTION

### History

Development in the Raft River Area began in the mid 1800's. The earliest surface water right is said to have a priority date of 1872 (Nace and Others, 1961). By the late 1880's, nearly all available surface water had been appropriated. Ground water development for agriculture began in the 1920's. Although it was in the 1950's that large remote areas were developed for irrigation with ground water.

By 1960 pumpage of ground water had markedly affected flow in Raft River and ground water levels were declining in other areas. Based on this the State Reclamation Engineer, in order to protect established water rights, closed the area to further appropriations of ground water in 1963. Since that time boundaries have been modified, but the main basin containing Raft River has been maintained as a Critical Ground Water Area (CGWA). The Idaho Department of Water Resources (IDWR) and U.S. Geological Survey (USGS) have also completed several studies in the area and monitored stream flow and ground water levels .

### Purpose and Scope

Purpose of this report was to update and compile data generated from the area and to suggest any possible changes needed in the monitoring system.

Scope included a review of previous investigations, compilation of precipitation, stream, and ground water level data, a review of records at the Agriculture Stabilization and Conservation Service office, and a reconnaissance to the area.

### Site Description

The site is located in Southern Idaho in Cassia County (see Figure 1, "Site Location Map"). It is bound by the Cotterell and Jim Sage Mountains to the west, the Snake River and Snake River Plain to the north, the Sublett and Black Pine Mountains to the east, and the Raft River Mountains in Utah to the South. The headwaters for Raft River are in the Raft River Mountains southwest of the area in Utah.

The climate is semi-arid with cold winters and hot dry summers. Figure 2 "Snow Data", presents snow course data from Logger Springs located in the highlands

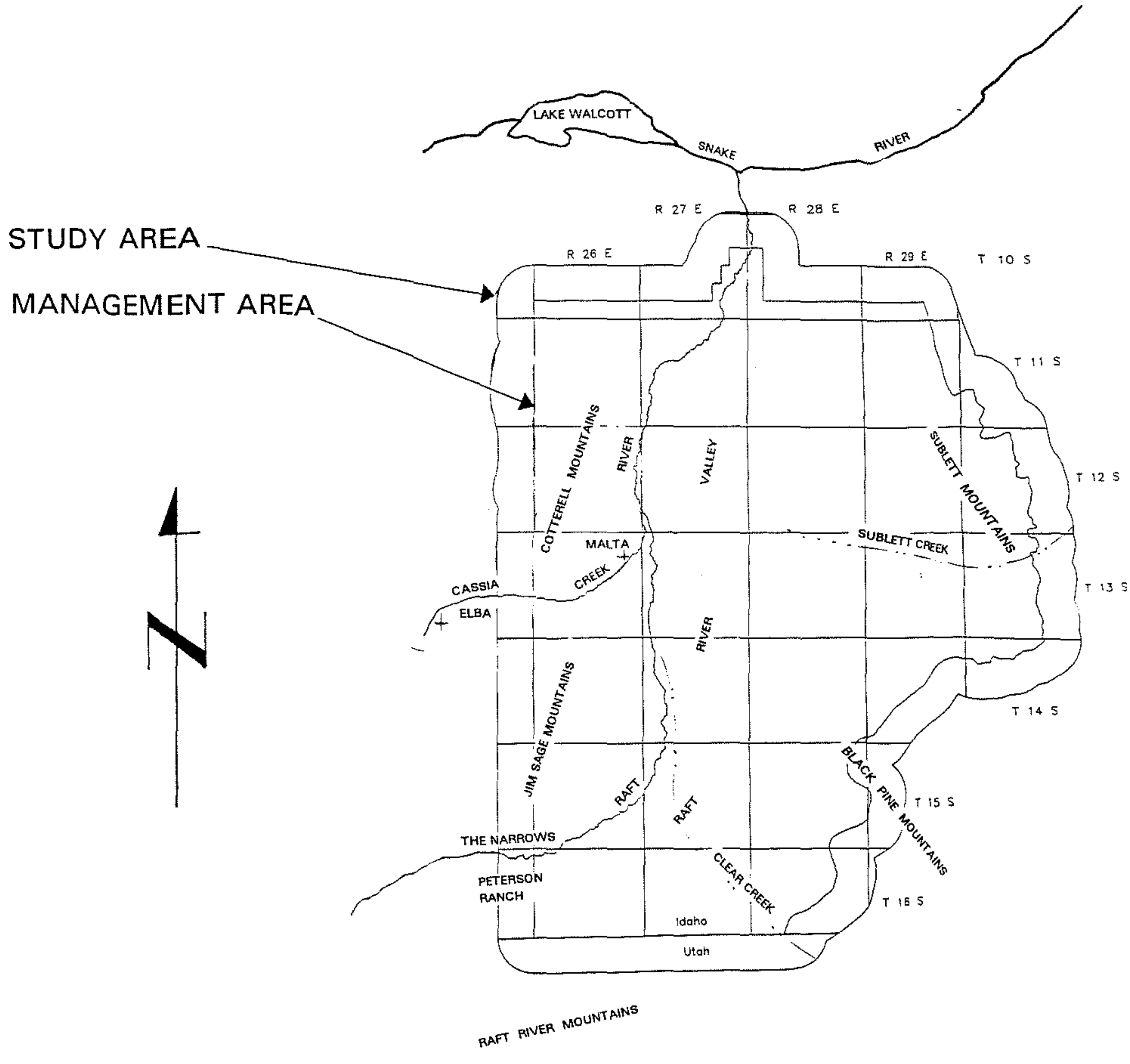
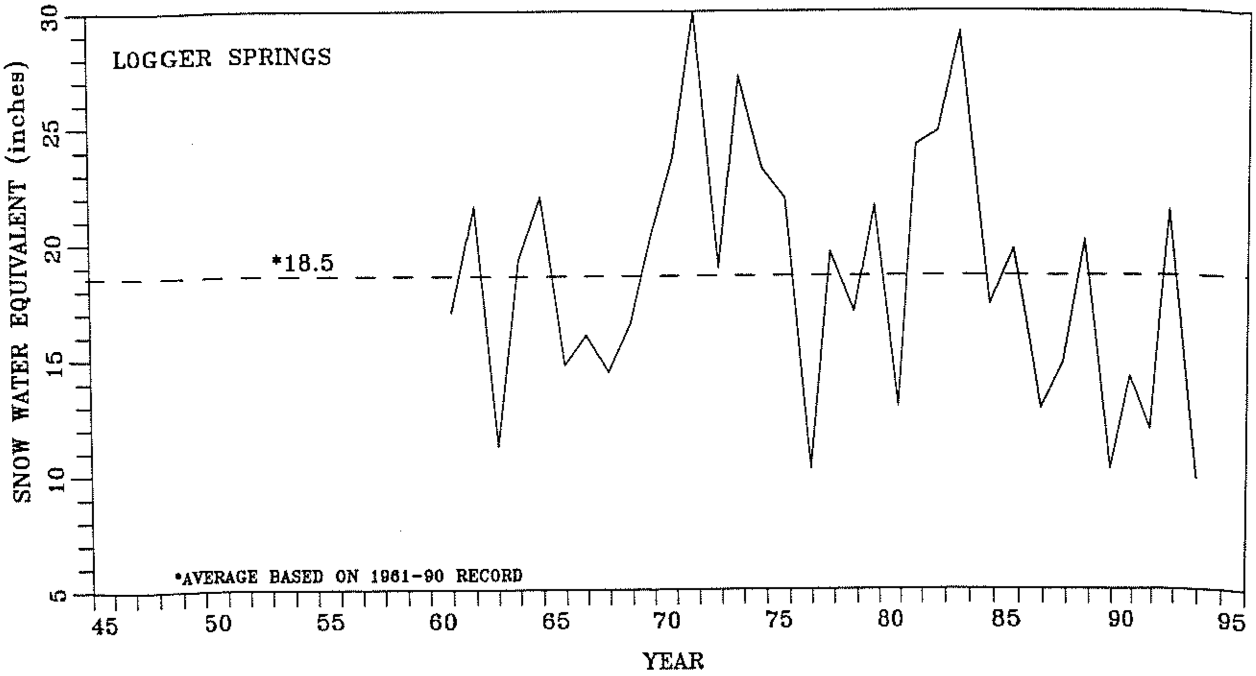



**FIGURE 1. SITE LOCATION MAP**



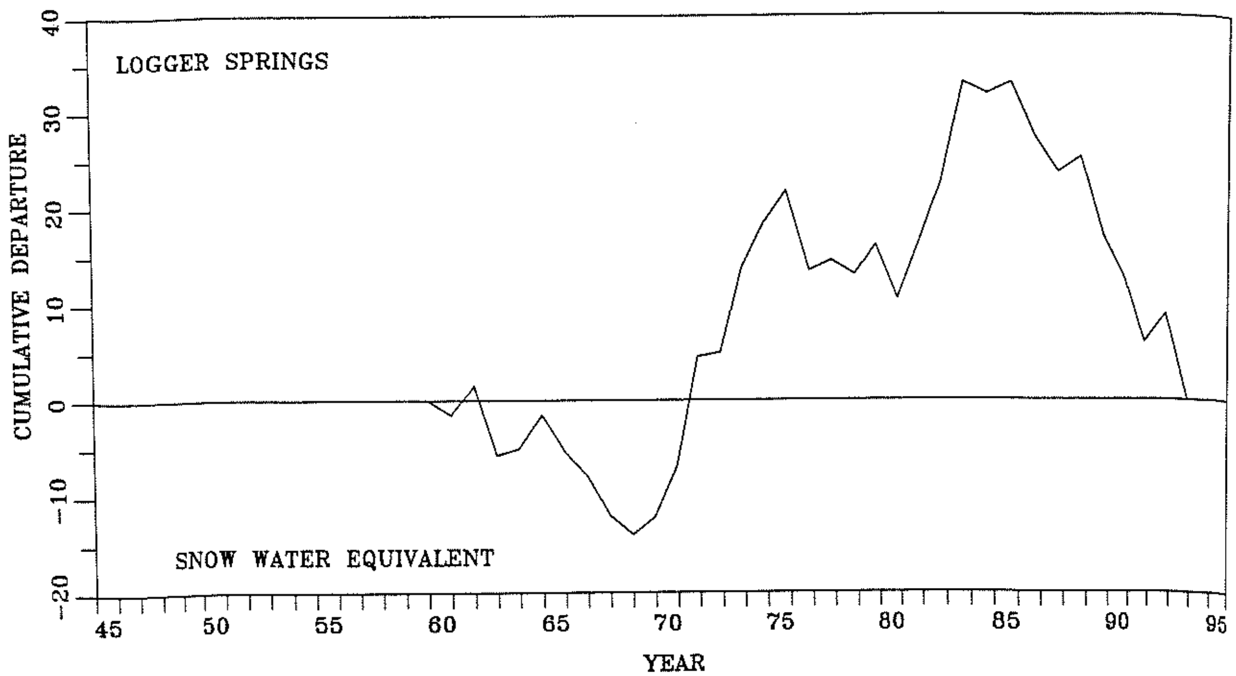




**FIGURE 2. MAXIMUM SPRINGTIME SNOW WATER EQUIVALENT**

southwest of the area which drains into the Raft River Basin. Presented is both the raw data and cumulative departure. The current drought is apparent in both, while the overall downward trend, as related to ground water, is seen best in the cumulative.

Figure 3 "River Data", presents Raft River flow at Peterson Ranch in the southwest part of the area. Below the gage flow diminishes due to infiltration and the river has virtually no surface flow in the study area. No flow record is available from the early 1970's to the mid 1980's. As seen the current drought has significantly diminished flow.

Other streams which flow into the area are Cassia Creek, Clear Creek, and Sublett Creek. No long term flow data are available for any of the three. Like raft River, none of these streams completely cross the area.

Farming and ranching are the primary industries. The main crops are alfalfa, cereal crops, sugar beets, and pasture. Dairy farming is present, but not widespread. Most of the agricultural development is in the northern part of the area and adjacent to Raft River.

Figure 4, "Ground Water Development" presents how the resource has been developed over time by showing the number of wells increasing with time. It is noted that this does not show the total number of wells, but the number in the IDWR and USGS well inventory and should be representative of the general trend. Most development took place in the 1950's.

Geothermal water can be encountered in the southern part of the basin. During the 1970's development of the resource was attempted, but since the early 1980's development has ceased.

## HYDROGEOLOGIC REGIME

### Geology

The following is a brief geologic description as presented by Bond (1978) and others.

For simplicity, the area can be divided into seven basic rock types (see Figure 5, "Geologic Map"). Quaternary alluvium, colluvium, and detritus cover the valley floors. Lying beneath this are Pleistocene basalts from various Snake Plain flows. Pliocene welded tuff, ash, and flow rock underlay this, along with limited stream and lake deposits from the same time period. At the base lie a variety of sedimentary and metamorphic rocks. The Quaternary units along with the basalts, tuffs, ashes, and flow rock comprise the major aquifers.

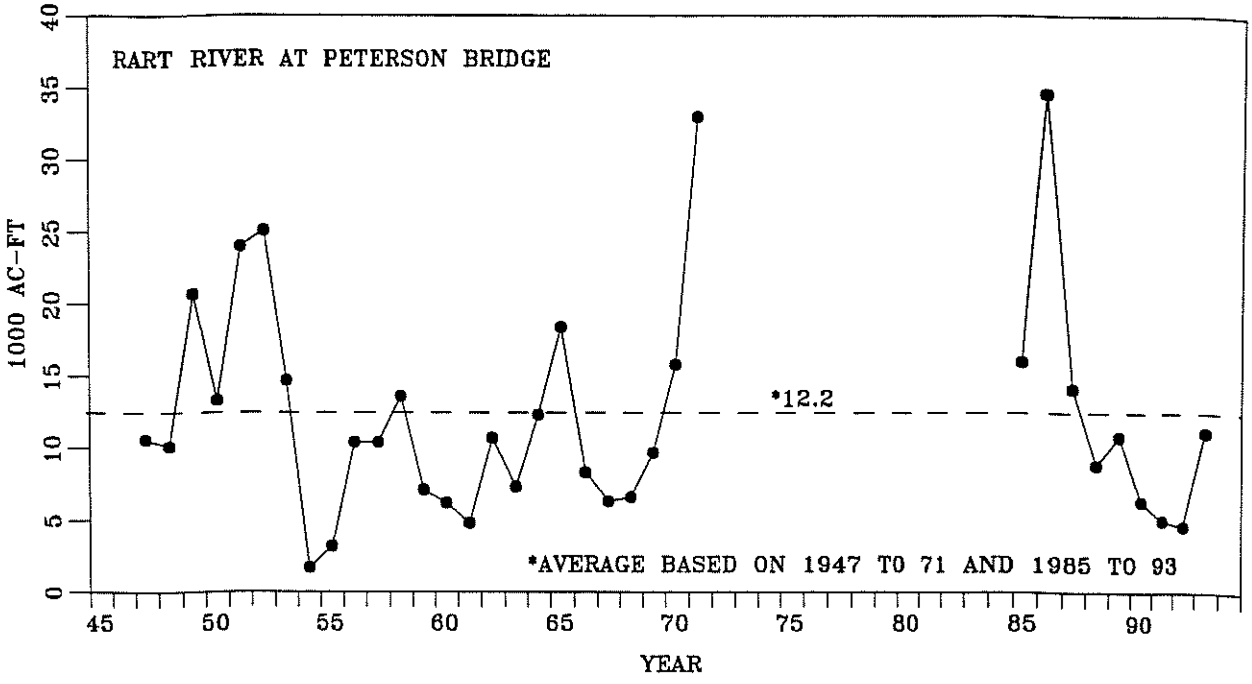



**FIGURE 3. RIVER DATA**

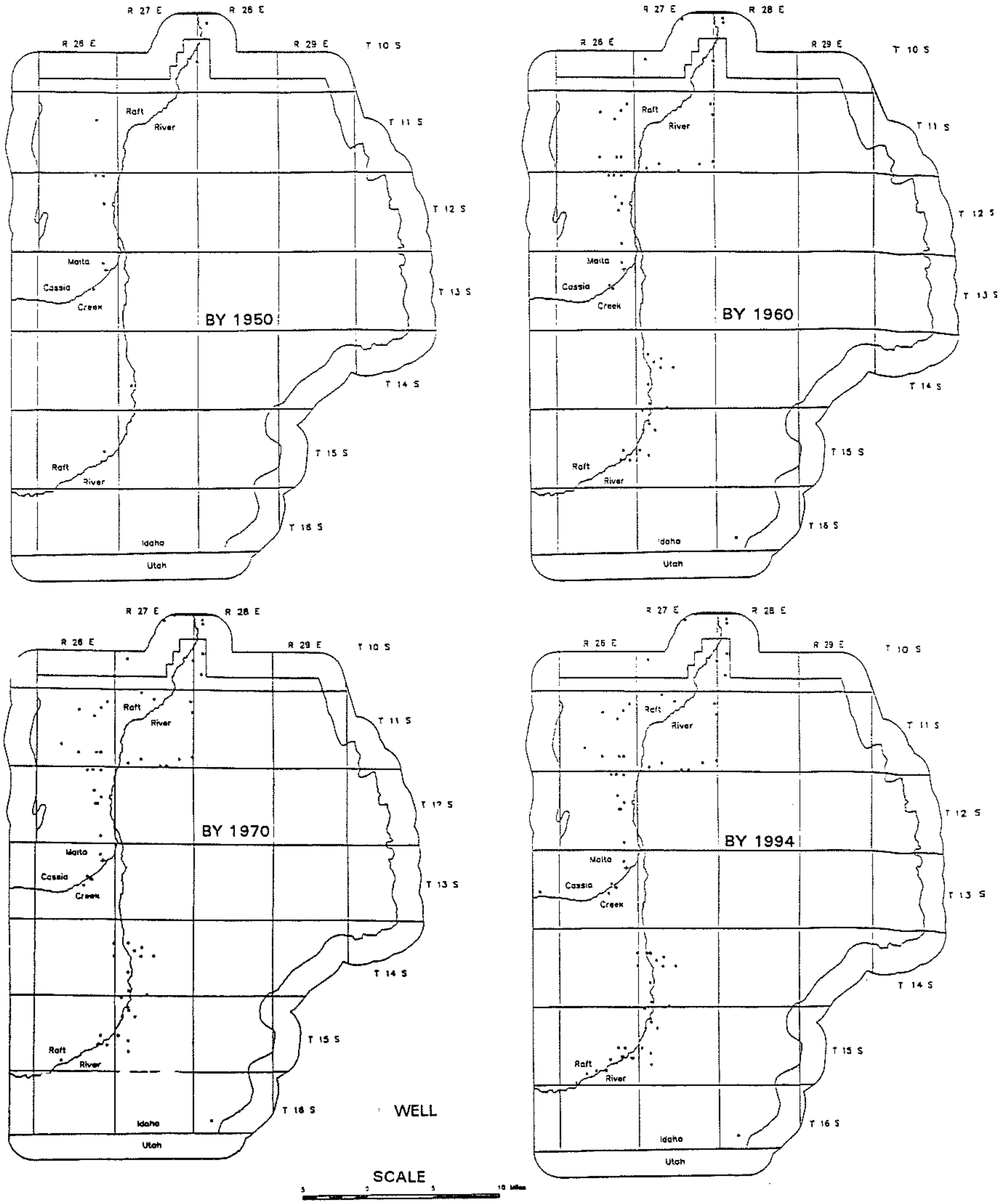
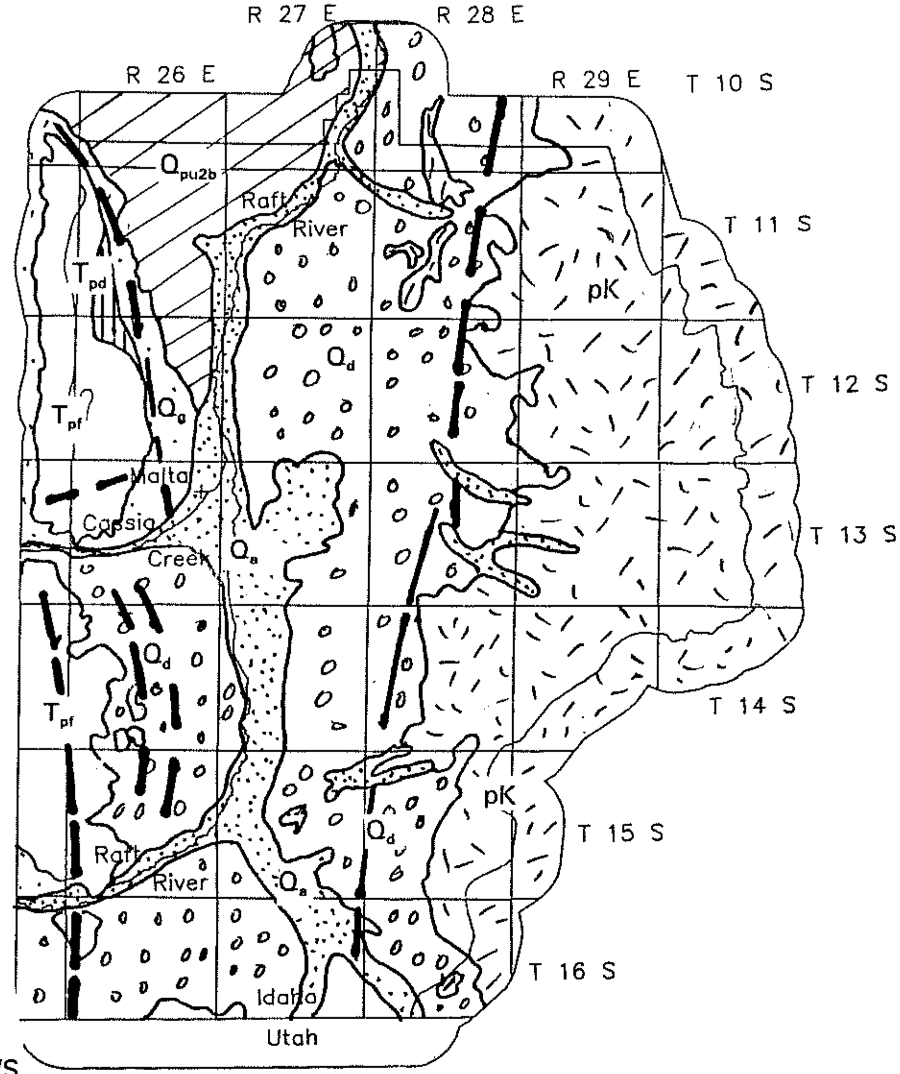



**FIGURE 4. GROUND WATER DEVELOPMENT**




ADAPTED FROM BOND, (1978)

SCALE 1:500000

5 0 5 10 Miles

**LEGEND**

FAULT

$Q_a$ QUATERNARY ALLUVIUM

$Q_g$ QUATERNARY COLLUVIUM

$Q_d$ QUATERNARY DETRITUS

$Q_{pu2b}$ BASALT: UPPER PLEISTOCENE SNAKE PLAIN FLOWS

$T_{pf}$ PLIOCENE SILICIC WELDED TUFF, ASH, AND FLOW ROCK

$T_{pd}$ PLIOCENE STREAM AND LAKE DEPOSITS: MAY BE DUE TO VOLCANIC AND BLOCK FAULTING EVENTS

*pK* *Pre-CRETACEOUS ROCKS:* WIDE VARIETY OF CONSOLIDATED SEDIMENTARY AND METAMORPHIC ROCKS

**FIGURE 5. GEOLOGIC MAP**

Structurally, the area is controlled by block faulting. The Jim Sage and Cotterell Mountains lying to the west are uplifted blocks as are the Sublett Mountains to the east. Lying between is the downthrown block or Raft River Valley. The fault escarpments are overlain or covered by younger deposits and were probably first inferred by Anderson (1931). Nace and others (1961) have inferred east-west faulting has created The Narrows (see Figure 1) in which Raft River flows and the valley in which Cassia Creek flows.

## Occurrence and Movement of Ground Water

In 1928 irrigation with surface water had reached a consumptive use rate of approximately 47,000 acre feet per year. Heavy pumping began around 1948 and ground water levels began to decline. Less water became available for stream flow diversion and by 1955 only an estimated 34,000 acre feet was being consumed. By 1960 this had dwindled to 27,000 acre feet and by 1966 to 20,000 acre feet or less than half of what was originally consumed by native riparian habitat before development. (Walker and Others, 1970).

With the decline in the water table of a few tens of feet, more areas became available for surface water to percolate or flow into the ground water system. Raft River ceased to flow in the main part of the basin except in flood years.

The relationship between surface and ground water is seen best in Figure 6, "Depth to Water". Presented are contours showing the depth to ground water in the basin. While a generalization based on the limited number of data points (23), it is seen that Raft River and Cassia Creek enter the area and then "sink" or disappear into the subsurface. Therefore surface and ground water are so interrelated in the area that one cannot be effected without affecting the other.

Figure 7, "Ground Water Elevations", present contours from 17 wells measured in the spring of 1994. While again only a generalization based on the limited amount of data points, the flow follows Raft River and discharges into the Snake River Plain Aquifer. No current data are available, but it is assumed that runoff from the Sublett Mountains to the east is also flowing into the aquifer.

The geothermal system, located in the southern part of the area, is encountered at depths as shallow as approximately 500 feet. Spring flow in the surrounding foothills is probably fault related.

Thickness for the principle aquifers, can range from non-existent in the foothills or highlands to approximately 1500 feet in the central part of the valley. Total depth, if assuming that the ground surface is the uppermost part of the aquifer, is approximately the same.

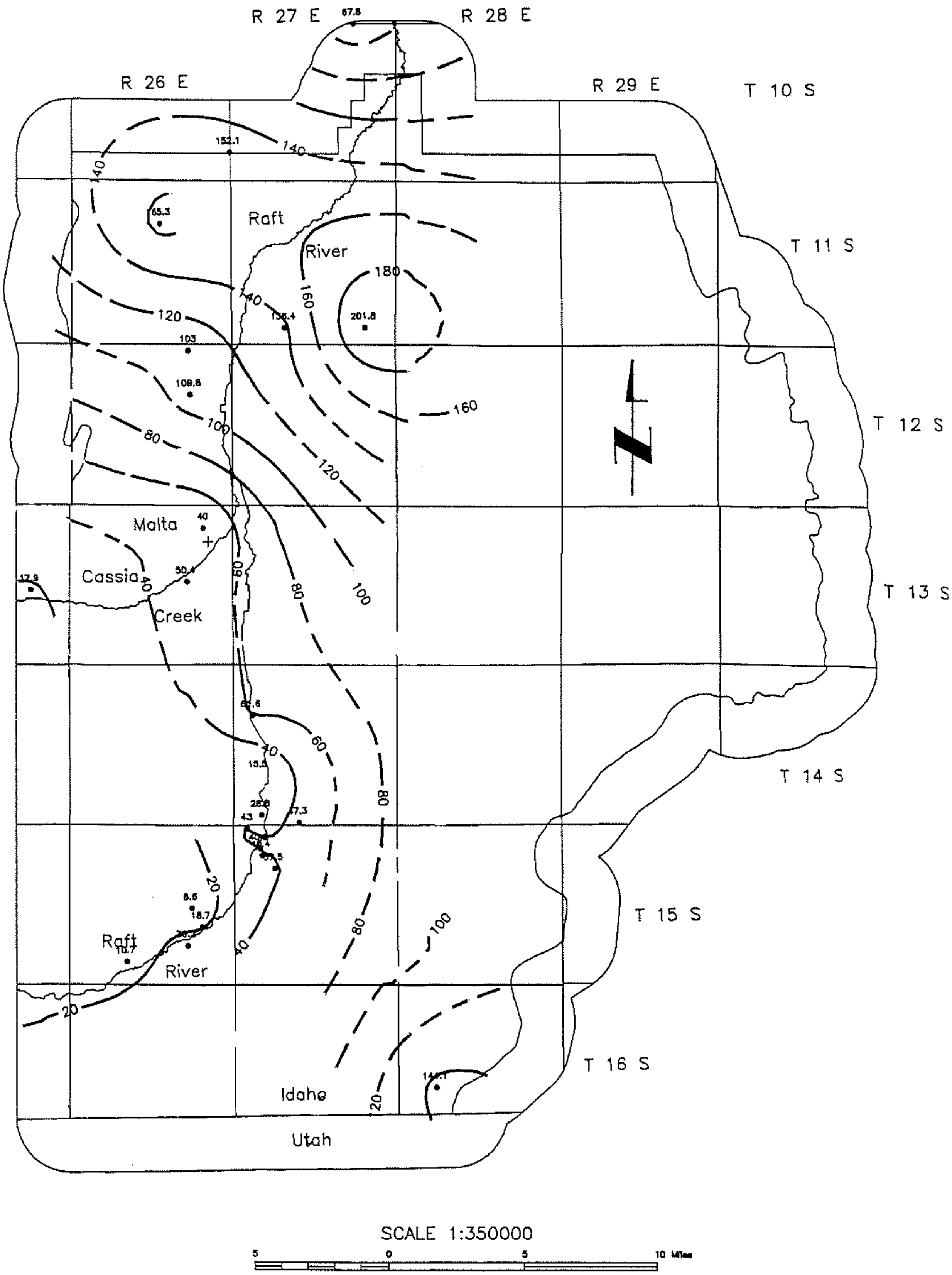
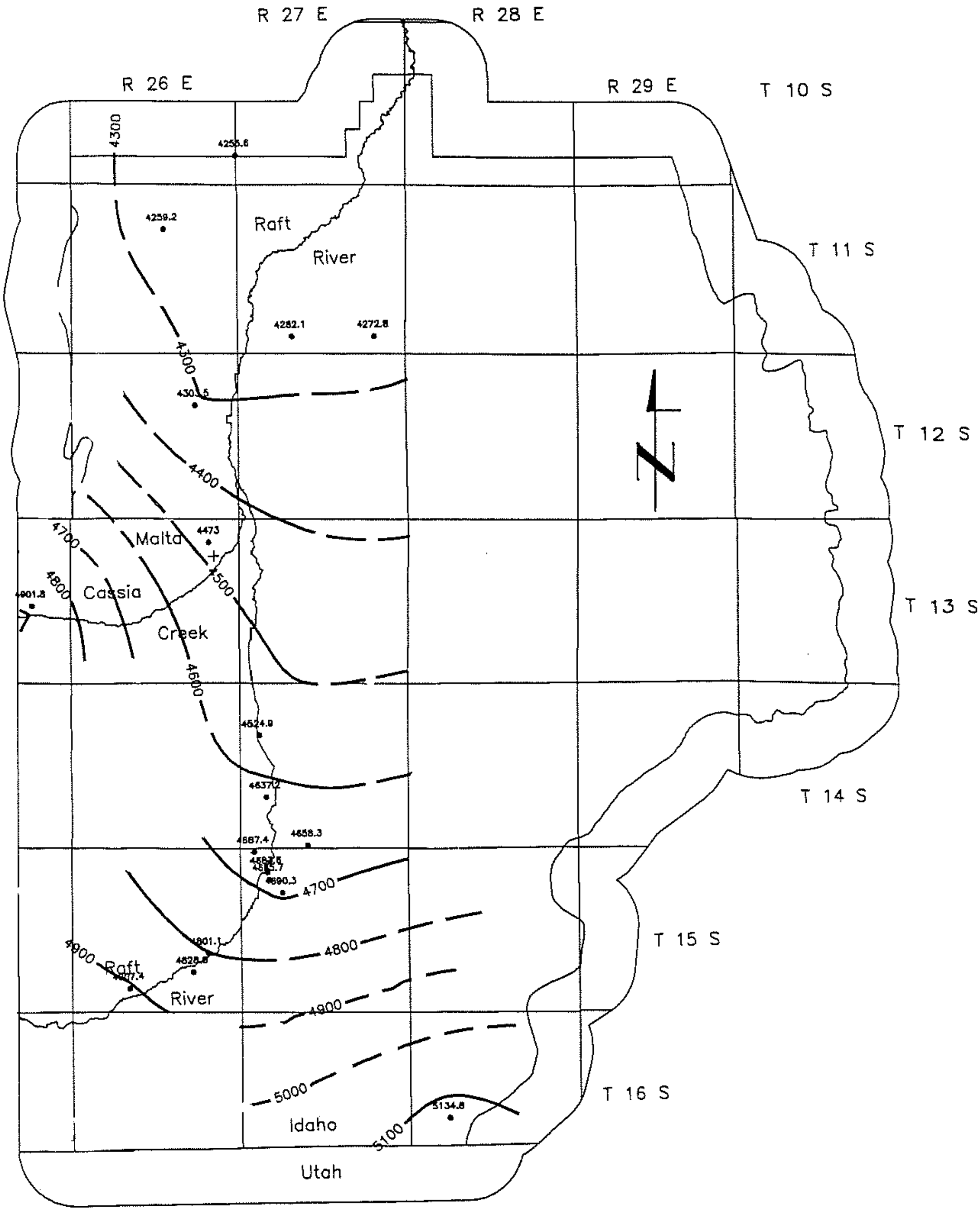



**FIGURE 6. DEPTH TO WATER**




SCALE 1:350000

5 0 5 10 Miles

**FIGURE 7. GROUND WATER ELEVATIONS**

## Recharge vs. Discharge

Figure 8, "Area Hydrographs" presents hydrographs for 14 of the wells monitored in the basin. Most measurements are taken in the spring and fall by the IDWR and the USGS. It is noted that the management area was once much larger and encompassed areas to the west. Wells are still monitored in these areas and ground water levels have only declined a few feet even during the current drought. These hydrographs are not presented. Only hydrographs within the management area are presented. All hydrographs are at the same scale and within the same time period.

As Figure 8 shows, ground water levels in the southern part of the basin have remained relatively stable. Changes seen are either probably due to pump cycles or wet and dry periods. Wells #7, #8, and #9 show trends similar to the cumulative departure for the snow course data at Logger Springs (see Figure 2). If a more continuous flow record was available for Raft River, the same trend would probably be seen. Overall levels have gone down since the 1950's, but the largest declines are associated with the current drought.

Moving farther northward, well #6 shows a dramatic decline (50 feet) associated with the current drought. Wells #12 and #13 show less drought related declines of approximately 25 feet.

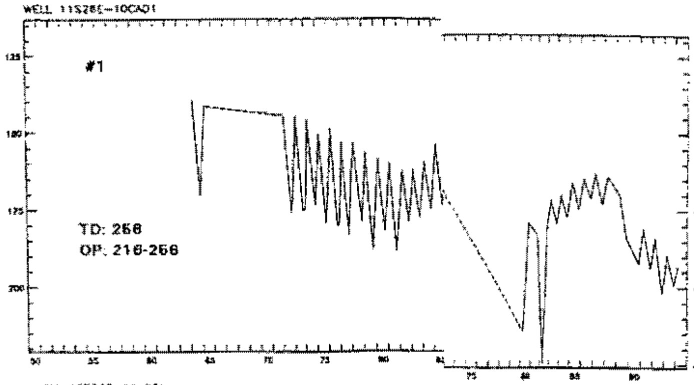
Wells #3, #4, #5, and #14 all show why the area was brought into management status. Recharge and discharge have been out of balance since the 1950's.

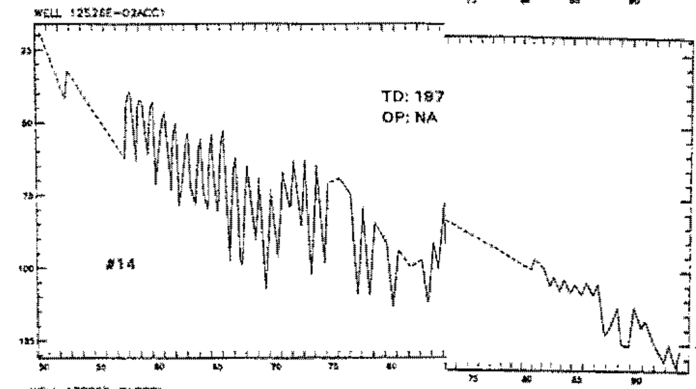
Wells #1 and #2 do show some drought decline, but have been relatively stable since the 1960's when monitoring first began.

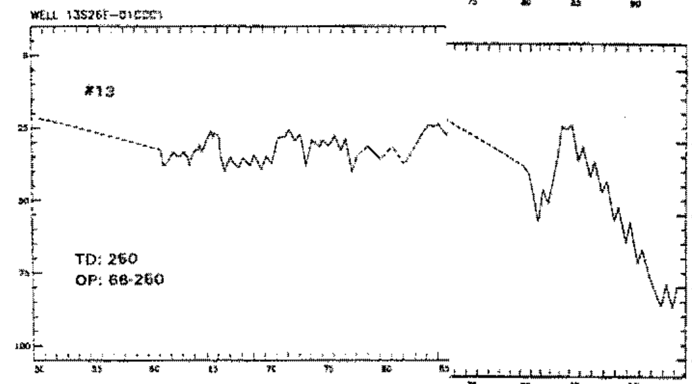
It is noted that wells #1, #2, and #14 were constructed in the basalts and show much larger seasonal fluctuations than other nearby wells constructed in sands and gravels (see Figure 5). Whether this is due to the different rock type or well construction is not known, but a difference is obvious. Published values though for transmissivity (T) and storativity (S), show that the sands and gravels will tend to have higher T values, but possibly lower S values. Therefore the basalts would show a larger initial drawdown, but a faster or better recovery. This could explain the difference in the hydrographs.

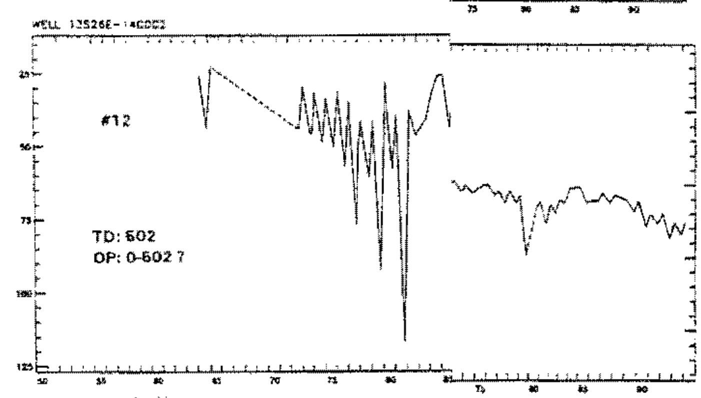
Figure 9, "Water Level Change: Spring 1984-1994" presents water level declines for the past 10 years. Declines to the south are drought related, while declines in the north are related to both the drought and over pumpage.

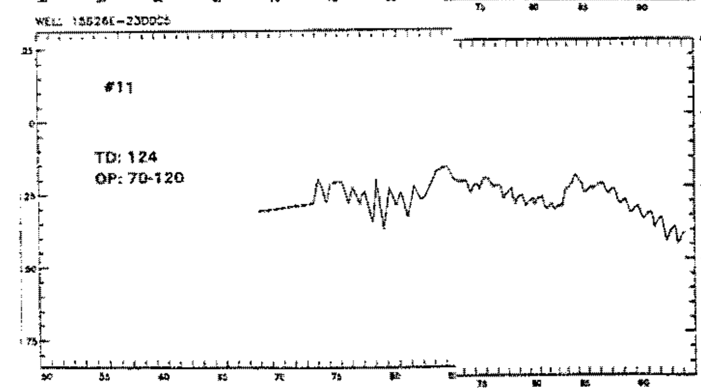
Ground water levels for some places in southern Idaho have responded to the Conservation and Recovery Program (CRP) which can take land out of production that




LEGEND

TD: TOTAL DEPTH

OP: INTERVAL IN WHICH WELL IS SCREENED OR PERFORATED AND OPEN TO THE AQUIFER.

NOTE: ALL MEASUREMENTS IN FEET. LEFT SIDE IS DEPTH TO WATER, RIGHT SIDE IS WATER ELEVATION.

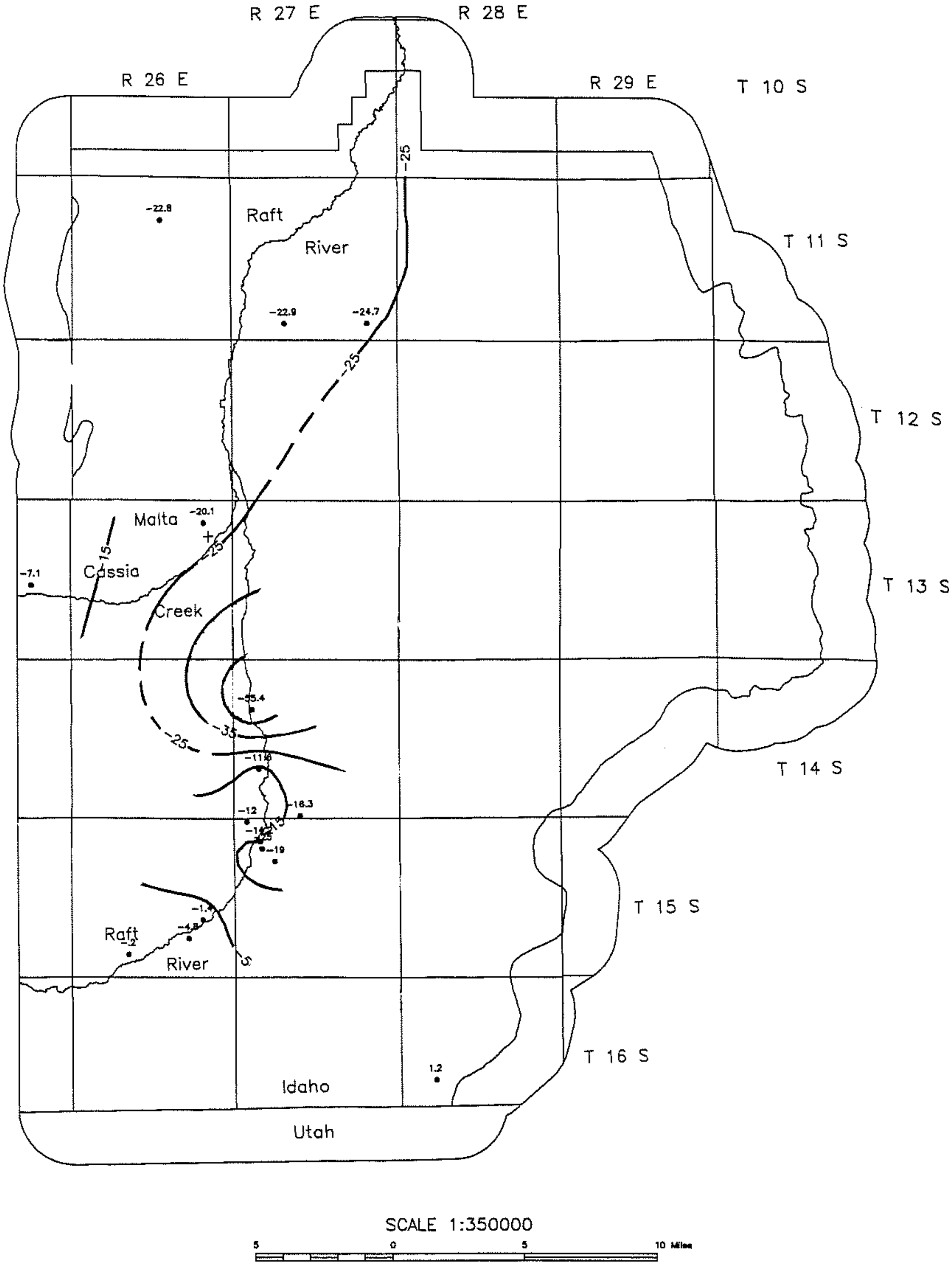



**FIGURE 9. WATER LEVEL CHANGE: 1984 - 1994**

was once irrigated with ground water. A review of records at the county ASCS office in Burley showed that only approximately 4000 acres in the Raft River Basin is in the program. This is a very small amount and not considered significant.

## CONCLUSIONS

With the exception of the area in the north central part, an equilibrium between discharge and recharge is being maintained. Increased usage to the south though, will only increase declines in the north by intercepting recharge. In the north central, declines averaging approximately 2 feet per year have been occurring since 1950.

The current monitoring system is sufficient and should not be changed.

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