SUMMARY OF GROUND WATER CONDITIONS

IN THE

OAKLEY FAN AREA

BY

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INTRODUCTION

HISTORY

Agricultural development in the Oakley Fan area began at the turn of the century. Extensive ground water development began in the 1950's. Four Critical Ground Water Areas (CGWA) have been established in the area: Artesian City (1962), Cottonwood (1962), Oakley-Kenyon (1962), and West Oakley Fan (1982). Bases for management status were declining water levels for all four areas.

Since that time numerous wells have been monitored by the U.S. Geological Survey (USGS) and the Idaho Department of Water Resources (IDWR). Several investigations have also been completed by the USGS in cooperation with the IDWR, and the Southwest Irrigation District. Therefore, a very strong database and a good understanding of the area has been developed.

PURPOSE AND SCOPE

Purpose of this report is to summarize current (spring, 1994) conditions and to suggest possible changes in the monitoring system.

Scope included a review of previous investigations, a reconnaissance to the area, compilation of water level hydrographs dating back to the 1950's, and a review of well drillers reports for the area.

PREVIOUS INVESTIGATIONS

Other reports completed in the area are Crosthwaite (1957), Mundorff, Crosthwaite, and Kilburn, (1964), Crosthwaite (1969), Edwards and Young (1984), Young (1984), Burrell (1987), and Young and Newton, (1989).

The most recent and informative was Young and Newton (1989). Ground water flow was simulated using a three dimensional finite difference model. Based on model simulation, ground water levels could have risen as much as 400 feet in the Oakley area, and 140 feet around Murtaugh Lake and south of Burley from the period 1910 to 1945. The rise would be due to additional recharge associated with surface water irrigation. The model also simulated a decrease in ground water levels for the period 1945 to 1970. Values ranged from 20 to 140 feet in the Murtaugh Lake area and 40 to 160 feet in the Oakley area. The decrease would be due to increased ground water development and flood irrigation techniques being replaced with sprinkler irrigation.

Currently the USGS is monitoring a federally funded aquifer recharge project in the Cottonwood area.

SITE DESCRIPTION

The subject area is located in south central Idaho in Cassia and Twin Falls Counties near the Snake River (see Figure 1, "Site Location Map"). It has been described as "broad, crescent shaped lowland" (Young and Newton, 1989). Elevation varies from approximately 4000 to 8000 feet above mean sea level, although the area of primary ground water interest generally lies below 4800 feet.

Farming and ranching is the dominant industry. Both are heavily dependant on ground water for irrigation.

Currently the USGS monitors approximately 30 wells in the four areas while the IDWR monitors approximately 20. The IDWR wells have records from approximately 1980, while records for some USGS wells date back to the early 1950's.

Figure 2 "Precipitation and Snow Course Data"' presents precipitation data from Howell Canyon (snow course) and Oakley (precipitation). The raw data are presented along with the cumulative departure. As seen the raw data shows no specific trend, but the cumulative departure does show trends or climatic sequences between dry and wet periods. The recent drought is also readily apparent for both. It is noted that the cumulative departure does not show or express magnitudes, but only trends.

Figure 3, "Stream Flow Data", presents the flow into Goose Creek Reservoir as the sum of Goose and Trapper Creeks. The data are only current for the 1993 water year. Data for the current year (1994) in which the snow pack was far below normal, are not available.

The year 1984 was the first time the reservoir completely filled since its completion in 1913. For the first time water was also released via the spillway. The Army Corp of Engineers and local residents also constructed a flood channel to the Snake River since the original had been "farmed in" or essentially destroyed.

OAKLEY FAN CRITICAL GROUND WATER AREAS

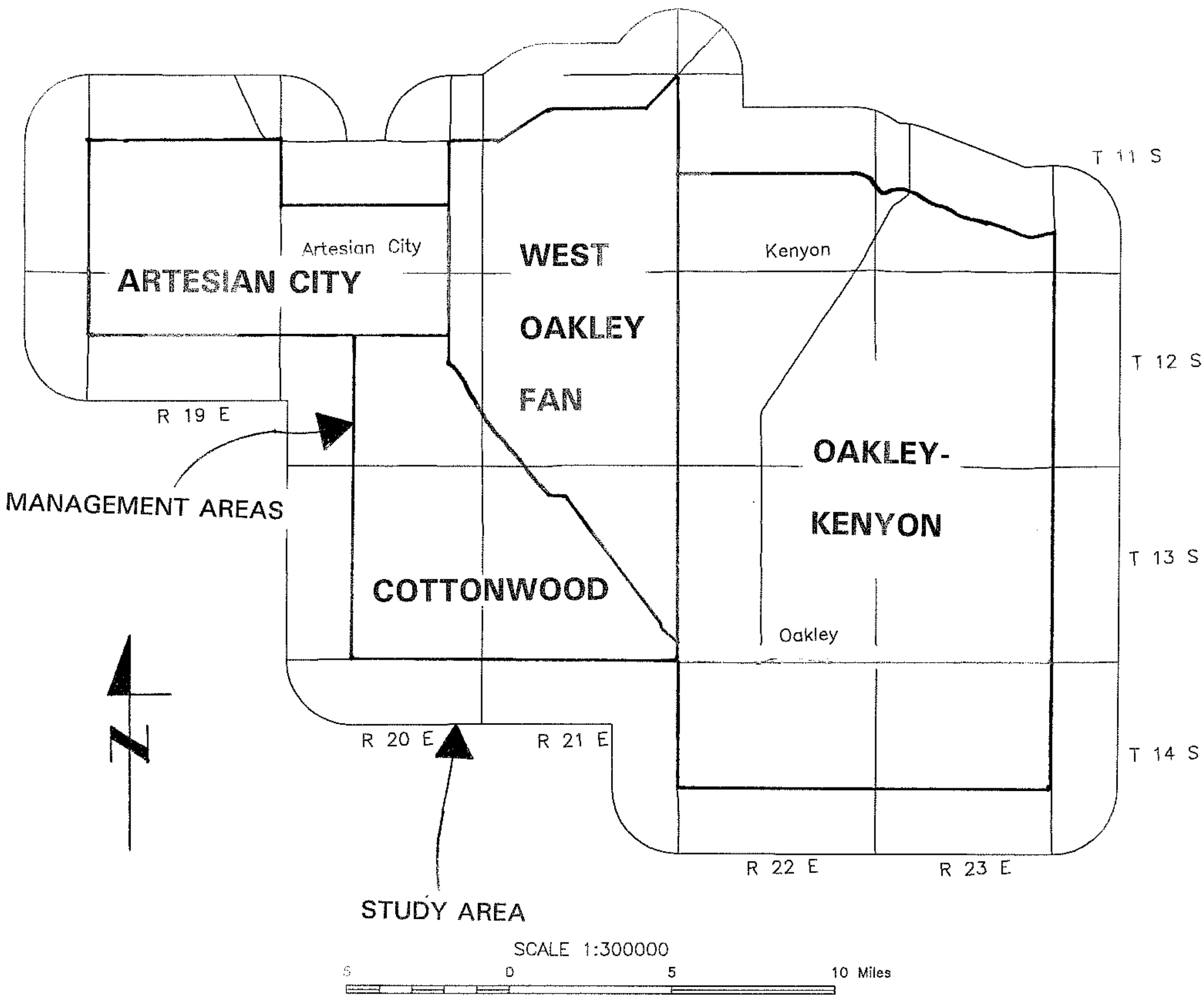

FIGURE 1. SITE LOCATION MAP

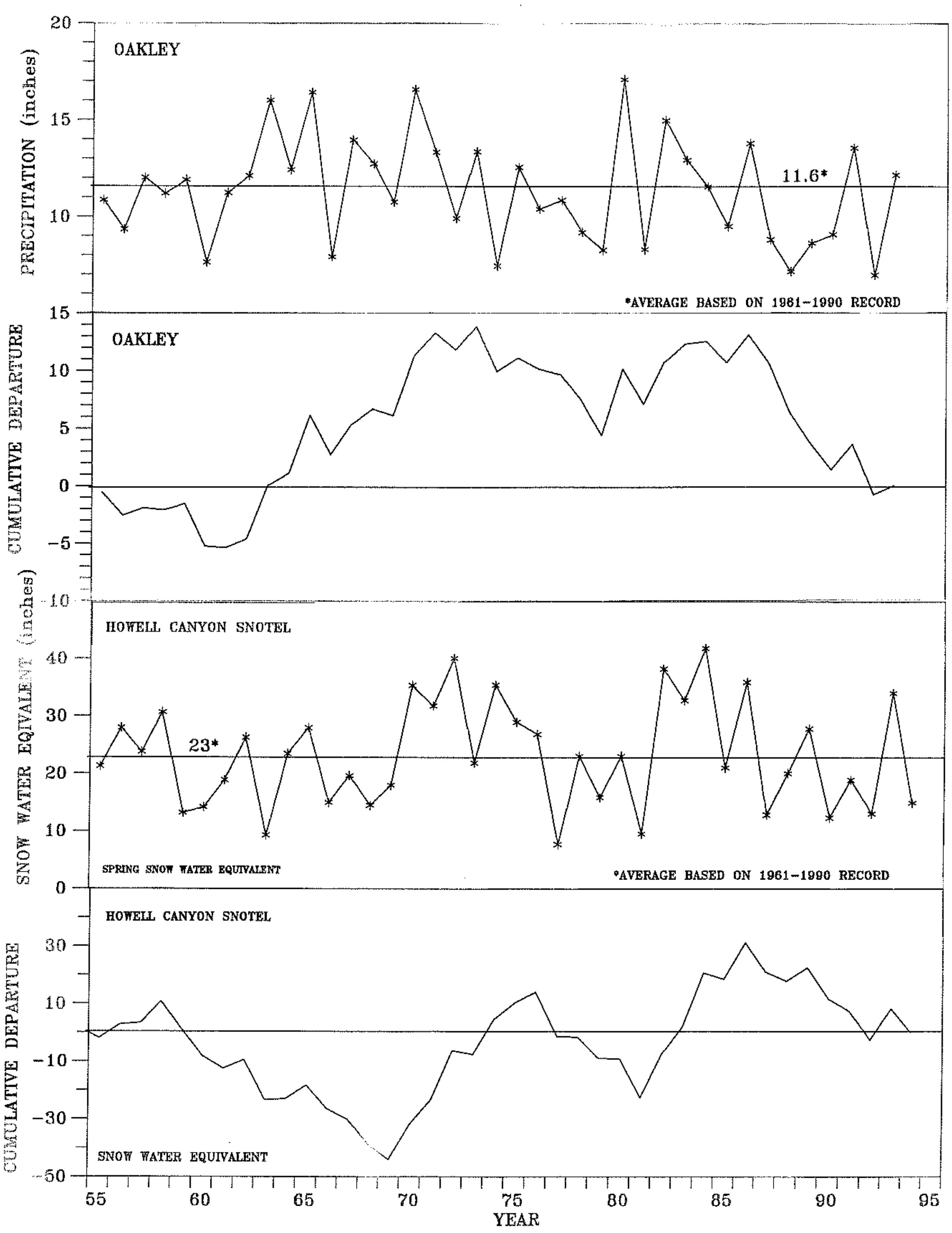

FIGURE 2. PRECIPITATION AND SNOW COURSE DATA

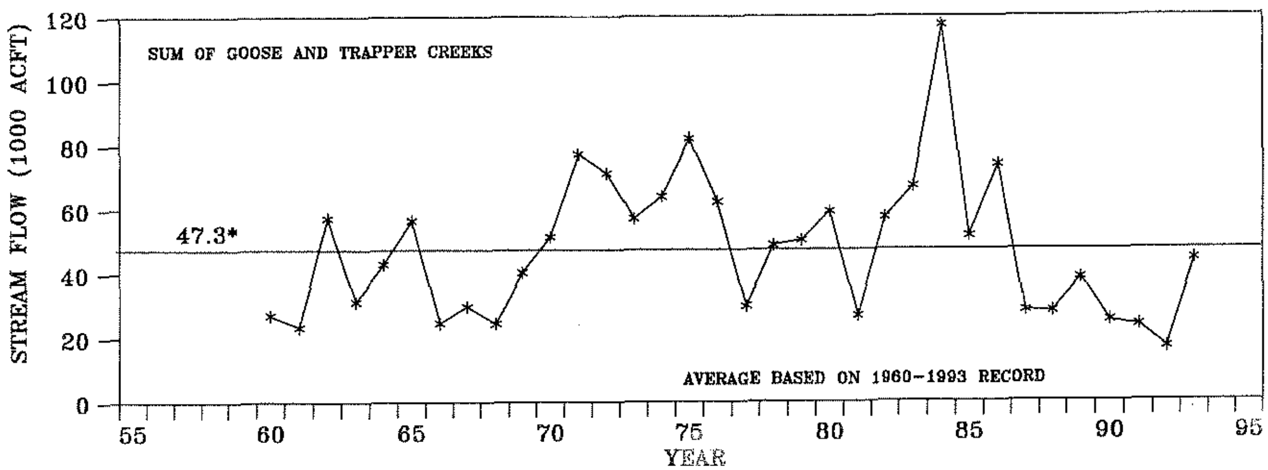

FIGURE 3. STREAM FLOW DATA

HYDROGEOLOGIC REGIME

GEOLOGIC FRAMEWORK

The following is a brief geologic summary as presented by Young and Newton (1989).

Four basic geologic units comprise the geology in the area (see Figure 4, "Geologic Map"). The most recent is Quaternary alluvium which contains unconsolidated deposits of clay, silt, sand, and gravel along with alluvial fan and wind blown deposits. Lying beneath this are Quaternary and Tertiary Basalts from the Snake River Group.

Tertiary silicic volcanics, composed mainly of welded ash flows, bedded tuffs, and lava flows of rhyolite, underlay the basalts. This is all underlain by undifferentiated Pre-Tertiary rocks which are predominantly massive quartzite, schist, and marine deposits of limestone. Some marble, sandstone, and shale are also present.

Two northwest trending faults (Foothills Road and Churchill Knolls) dominate the structure by controlling the flow and movement of ground water. Both are considered normal with the downthrown block lying between them.

OCCURRENCE AND MOVEMENT OF GROUND WATER

For simplicity, the area can be described as having four main aquifers; limestone, rhyolite (silicic volcanics), basalt, and alluvium. Conditions are assumed to be mostly confined in the limestone and rhyolite and unconfined in the basalt and alluvium. For purposes of this report all above mentioned aquifers will be referred to as the 'regional system'.

Young and Newton (1989) presented several areas where perched conditions exist. In the area surrounding and north of Oakley, a perched zone exists, probably associated with water from Lower Goose Creek Reservoir being used for irrigation. Where Big Cottonwood Creek disappears or sinks another perched zone exists.

In the northwest two other small perched zones exist most likely related to runoff from the uplands to the south. In the northeast, a large perched zone occurs and is recharge from the Snake River and surface water irrigation from the Burley Irrigation District (BID).

Figure 5 "Ground Water Elevations: March, 1994", presents the flow direction and relative gradient for the area. In the northeast the flow is southwest from the Snake

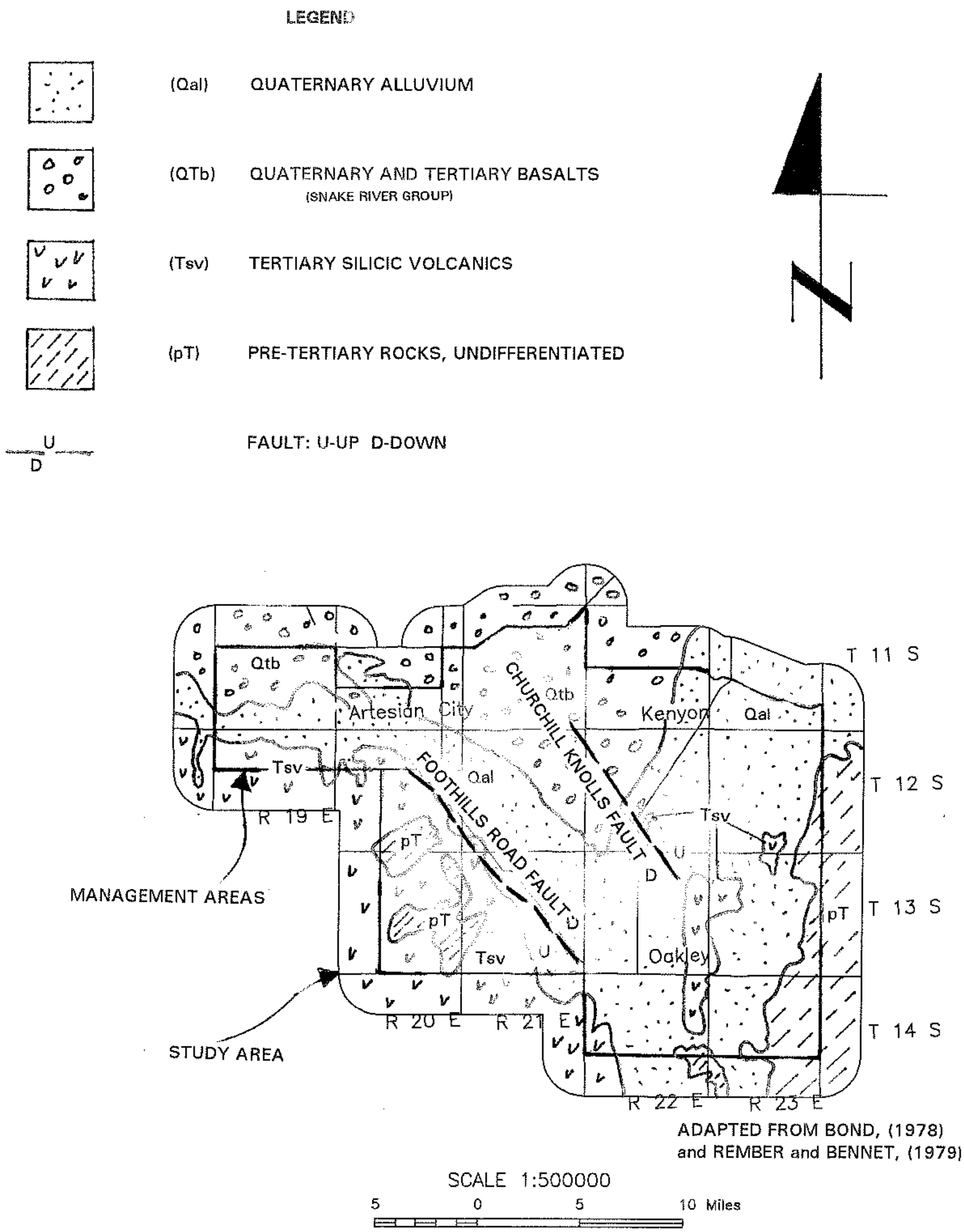

FIGURE 4. GEOLOGIC MAP

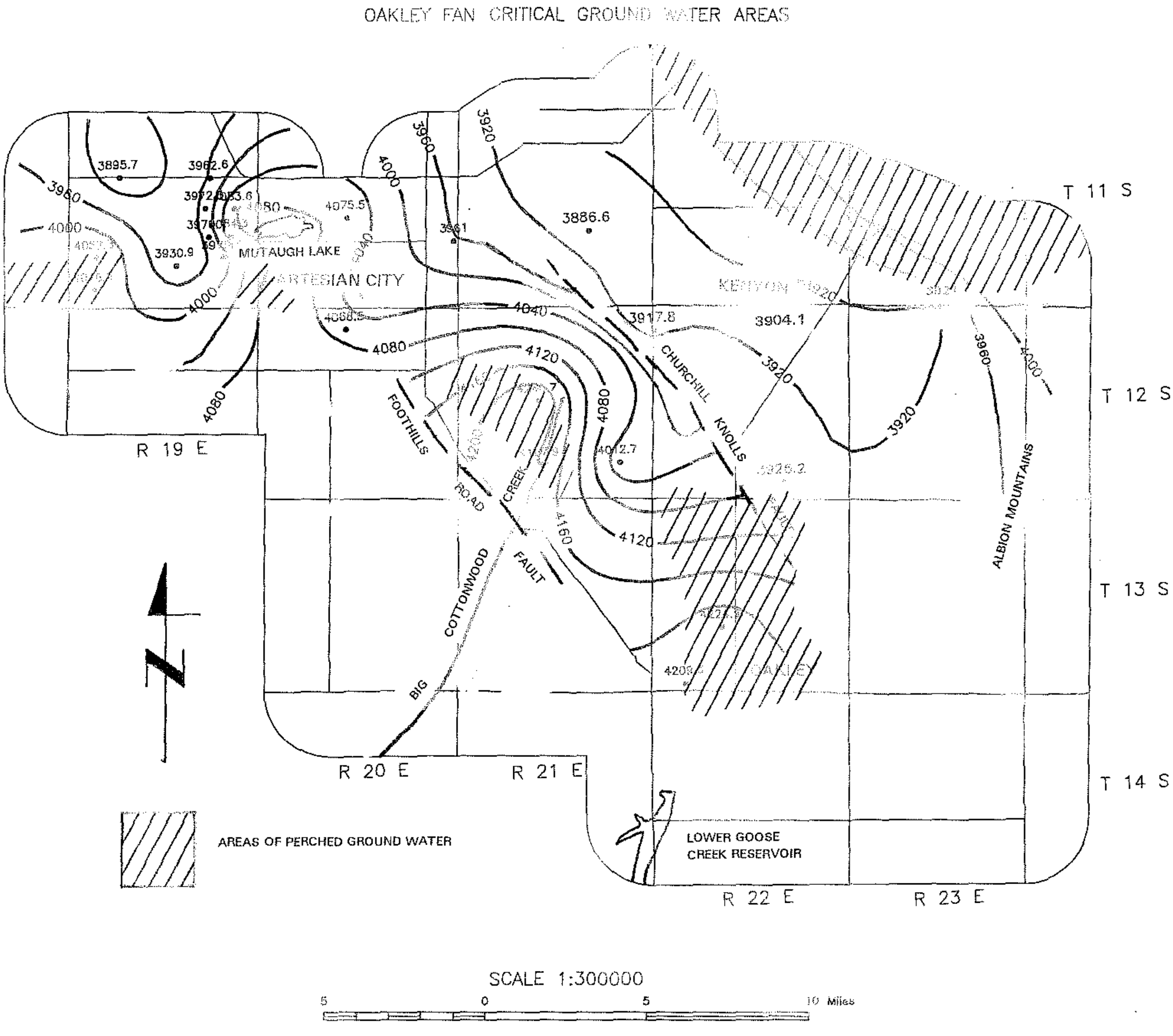

FIGURE 5. GROUND WATER ELEVATIONS: MARCH, 1994

River and canals from the BID. This is also a losing reach of the Snake River to the perched system (Young and Newton, 1989). Data were not available in the southeast for 1994.

Flow between the two northwest trending faults is north to northwest. To the northeast across the Churchill Knolls Fault, the gradient is much more gentle adding further evidence the fault is restricting flow.

To the southwest across the Foothills Road Fault, data are not available to determine a flow direction or gradient. A few wells do show differences in elevation of as much as 270 feet across the fault adding further evidence of a flow restriction. Surface flow across the fault by Big Cottonwood Creek is also evident by the irregular contours.

Northwest of Murtaugh Lake ground water flows back into the Snake River. The flow direction is almost radial around Murtaugh Lake. Young and Newton, (1989) describe seepage from the lake as related to ground water pumpage. When ground water levels decline, seepage from the lake increases. Therefore, the flow may be described as head dependant or saturated.

Between Milner Dam and a point north of Murtaugh Lake, river elevations and ground water levels indicate that flow passes under the Snake River to join the Snake Plain Aquifer.

RECHARGE VERSUS DISCHARGE

Figure 6, "Summary Hydrographs", presents selected USGS hydrographs from 14 wells chosen to be most representative of the area. Each is marked with the wells total depth, openings to the aquifer, and whether it is in the regional or perched system or possibly both. The same scale and time period is used for all wells.

While data in 1994 are not available to determine water level change in the east, data generated in 1984 suggests, as would be expected, some recharge comes from the Albion Mountains. The amount and effects on ground water levels are not known.

Recharge to the south appears very dependant on irrigation water released from Lower Goose Creek Reservoir. Hydrographs #8 and #9 both reflect the 1984 water year in which water was released through the reservoirs spillway. The effects of the recent drought are also readily apparent.

Water level data from well #8 (a USBR well) are suspect. It was learned that well in 1992 was pumped with large quantities of sand removed. The static water level was lowered approximately 100 feet and has never recovered to its prior level. Therefore the sand was obstructing flow and the well was (and possibly still is) essentially

FIGURE 6
"SUMMARY HYDROGRAPHS"
IS MISSING
CURRENT HYDROGRAPHS
ARE AVAILABLE UPON REQUEST

plugged.

The decline of 230 feet for the high water mark in well #9 may also be suspect. Though information regarding well openings are not available, it was drilled as an irrigation well in 1958 and was probably opened (perforated or screened) to all water bearing strata. This is also an area where perched water is encountered. Therefore flow from the perched to the regional system via the well is probably taking place.

Figure 7 "Mounding Effects" illustrates how mounding may be effecting the water level in the well. Though idealized, it is seen that the water level in the well would not be representative of either the perched or regional system. Water levels recorded before 1987 were possibly elevated due to mounding. Therefore declines have occurred as a result of the current drought, but mounding may be amplifying the total decline. The system presented is unconfined as Young and Newton (1988) described it. A confined system though would respond in much the same way.

The same effect is also seen northward in well #7. Well #7 is open to both the perched and regional system. The wet period beginning in 1984 and the recent drought is much more pronounced than in other areas.

It is also possible that the entire regional system in the Oakley area is 'mounded'. Through communication with Bill Young of the USGS (July 24, 1994), in wet years surface water from Lower Goose Creek Reservoir is abundant and few if any irrigation wells are pumped. Therefore the aquifer(s) are being recharged and not stressed. Conversely, on dry years the aquifer(s) are stressed and receive little if any recharge. Therefore a regional 'mound' may exist during wet years. This assumes saturated flow (ie no perched zone).

Therefore whether mounding is taking place and if it is regional or isolated to certain wells, is not known. But the declines of over 200 feet are suspect and a decline of approximately 100 feet in the Oakley area is probably most representative. This also corresponds to the low water mark for well #9.

Wells lying southwest of the Foothills Road Fault in the Cottonwood Area (#10 and #11), show dramatic declines while the area was being brought into management status, but have since come closer to equilibrium between recharge and discharge. Though minuscule at the scale used, the slight spike in 1993 for #10 is a result of the current recharge project in the Cottonwood area. Since 1970, #11 also shows trends similar to snow and precipitation data (Figure 2). This may suggest a balance between recharge and discharge could be approaching. Recharge is probably dependant on runoff from uplands to the southwest.

Well #12 has declined approximately 200 feet since 1955. Recharge is probably

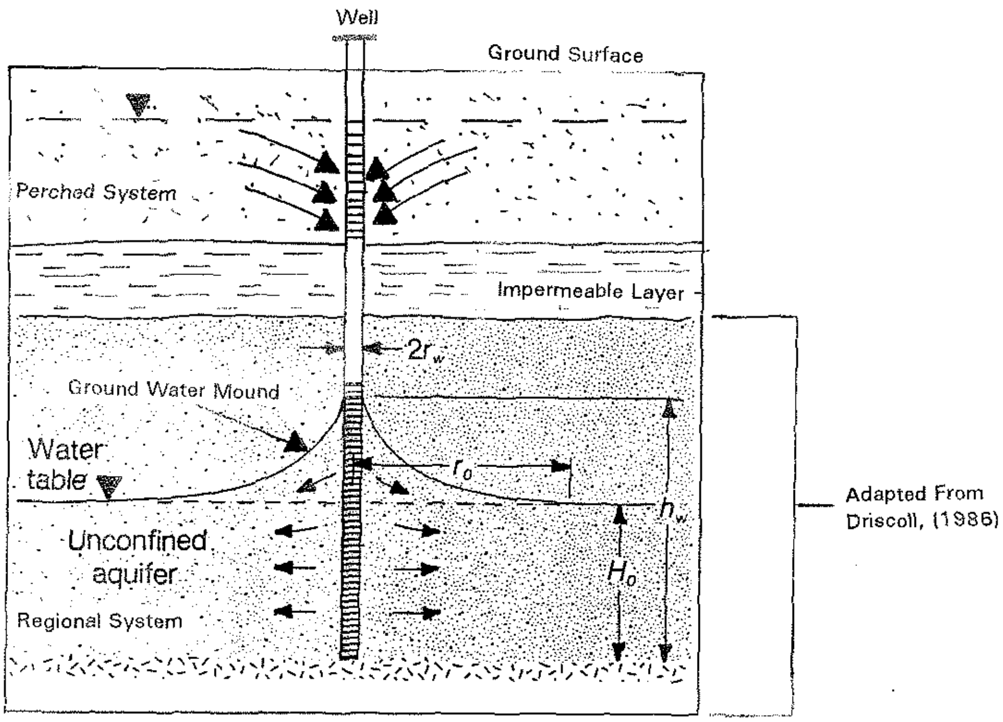

FIGURE 7. MOUNDING EFFECTS

dependant on precipitation in the uplands to the south and possibly leakage from Murtaugh Lake. Equilibrium between recharge and discharge has not yet been achieved.

Areas which receive recharge from either the Snake River, BID, or Murtaugh Lake, appear to be more stable or closer to a balance between recharge and discharge.

Figure 8, "Water Level Change: 1984-1994", presents the areal distribution of ground water level changes between the spring 1984 and spring 1994 measurements. While all areas show declines, it must be remembered that 1984 was a very wet year and it is being compared to the effects of the current drought.

CONCLUSIONS

Some areas in the Oakley Fan may be approaching equilibrium between recharge and discharge. In other areas, declines are continuing, but at much reduced rates despite the current drought.

The current monitoring system is sufficient and should continue.

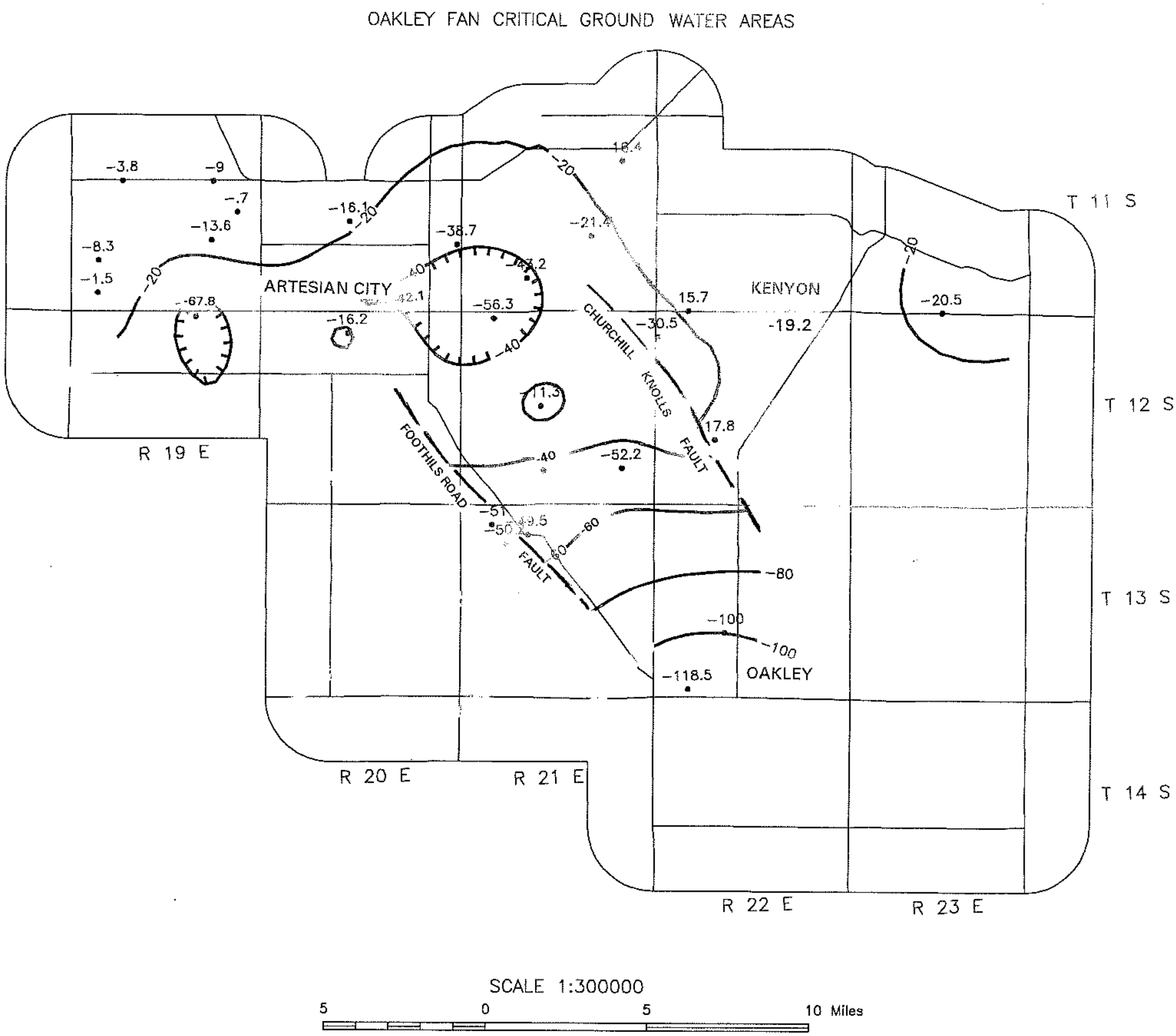

FIGURE 8. WATER LEVEL CHANGE MAP: 1984-1994

REFERENCES

Burrell, S.C., 1987, Estimating Ground Water Recharge in Irrigated Areas of an Agricultural Basin: Moscow, Idaho, University of Idaho, unpublished thesis, 172 p.

Crosthwaite, E.G., 1957, Ground Water Possibilities South of the Snake River between Twin Falls and Pocatello, Idaho: U.S. Geological Survey Water Supply Paper 1460-C p. 99-145.

Crosthwaite, E. G., 1969, Water Resources of the Goose Creek-Rock Creek area, Idaho, Utah, and Nevada: Idaho Department of Reclamation, Water Information Bulletin 8, 73 p.

Driscoll, F. G., 1986, Ground Water and Wells, Second Edition: Published by Johnson Division, St. Paul Minnesota 55112, p. 769-777.

Edwards, T.K.,and Young H.W., 1984, Ground Water Conditions in the Cottonwood-West Oakley Fan area, south central Idaho: U.S. Geological Survey Water Resources Investigations Report 84-4140, 32 p.

Mundorff, M.J., Crosthwaite, E.G., and Kilburn, Chabot, 1964, Ground Water for Irrigation in the Snake River Basin in Idaho: U.S. Geological Survey Water Supply Paper 1654, 224 p.

U.S. Geological Survey, and Idaho Department of Water Resources, Water Resources Data, Idaho, Water Year 1993, Volume 1; Great Basin and Snake River Basin above King Hill, 401 p.

Young, H.W., 1984, Potentiometric-surface Contours, Directions of Ground Water Movement, and Perched Water Zones, Oakley Fan, southeastern Idaho, March-April 1984: U.S. Geological Survey Water Resource Investigations Report 84-4231, 44 p.

Young, H.W., and Newton, G.D., 1989, Hydrology of the Oakley Fan Area, South Central Idaho, U.S. Geological Survey Water Resource Investigations Report 88-4065, 73 p.