DEPARTMENT OF THE INTERIOR
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GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, ARIZONA

by

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INTRODUCTION

This report on ground-water units and withdrawal in the Basin and Range province of Arizona (see index map) was prepared as part of a program of the U.S. Geological Survey to identify prospective regions for further study relative to isolation of high-level nuclear waste (Bedinger, Sargent, and Reed, 1984), utilizing program guidelines defined in Sargent and Bedinger (1984). Also included in this report are selected references on pertinent geologic and hydrologic studies of the region. Other map reports in this series contain detailed data on ground-water quality, surface distribution of selected rock types, tectonic conditions, areal geophysics, Pleistocene lakes and marshes, and mineral and energy resources.

ACKNOWLEDGMENTS

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GROUND-WATER UNITS

This map shows boundaries of ground-water units, generalized directions of ground-water flow at the water table, areas of natural discharge to streams and lakes, areas of natural discharge by evapotranspiration in areas underlain by ground water at shallow depths, areas of discharge by wells where large withdrawals have caused depressions in the water table, and the distribution of consolidated rock outcrops and areas underlain by basin fill.

Ground-water unit boundaries are based primarily on ground-water divides or surface streams. The water table is used to delineate ground-water units in a manner analogous to the way land-surface topography is used to delineate drainage areas. Where information is available, water-level contour maps were used to define the boundaries. Where water levels were lacking, ground-water boundaries were drawn on topographic drainage divides that were assumed to overlie water-table divides.

Ground-water units shown on the map may contain one or more areas of natural recharge and natural discharge or ground-water withdrawal by wells. Some ground-water units comprise closed flow systems at the water table; that is, no ground-water flow occurs across the ground-water unit boundaries. However, between other units, ground-water flow may occur across some unit boundaries in basin-fill or consolidated-rock aquifers.

In the Basin and Range province, ground water occurs in basin-fill deposits and consolidated rocks. The basin fill consists mostly of unconsolidated to semi-indurated sedimentary deposits. The material ranges from poorly sorted to moderately sorted mixtures of gravel, sand, silt, and clay that were derived from the consolidated rocks in the nearby mountains. Evaporite deposits, limestone, conglomerate, and volcanic rocks are present in places in the unit. Some of the basins may contain as much as 9,000 feet of basin fill, but the most permeable rocks and most of the recoverable ground water is in the upper 1,000 feet of the unit.

The consolidated rocks consist mostly of sedimentary and volcanic rocks, with lesser amounts of metamorphic and intrusive rocks. The consolidated rocks make up the mountain ranges that border the basins and are the principal source of sedimentary material to the basin fill.

Few wells exist in the consolidated rocks compared to the number of wells in the basin fill. The yield of wells tapping many consolidated rock units is due to interception of water in fracture zones. In some areas in the Basin and Range province, carbonate rock is extensive in the subsurface and provides interconnection between alluvial basins through fractures and solution channels. Although the consolidated rock commonly has very low permeability and very low rates of ground-water flow, the entire ground-water system, including basin fill and bedrock, must be treated as one integral system.

Depressions in the water table have been created in many areas of large concentrated ground-water withdrawal. Major areas are approximately located on the map and may be the principal discharge mechanism for many of the ground-water units. The water table in these areas fluctuates seasonally in response to changes in withdrawal rates and distribution of ground water. In addition, within areas where ground-water withdrawal has increased, predevelopment of ground-water flow patterns commonly have been altered.

GROUND-WATER WITHDRAWAL

The accompanying map shows boundaries of ground-water withdrawal areas and estimated ground-water withdrawal for 1981.

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EXPLANATION

BOUNDARY OF GROUND-WATER UNIT.--Approximately defined by ground-water-table divides or topographic divides

BOUNDARY OF GROUND-WATER UNIT WHERE COINCIDENT WITH THE COLORADO RIVER.--Ground-water recharge and discharge areas are not delineated

BOUNDARY OF GROUND-WATER UNIT WHERE COINCIDENT WITH A GAINING STREAM

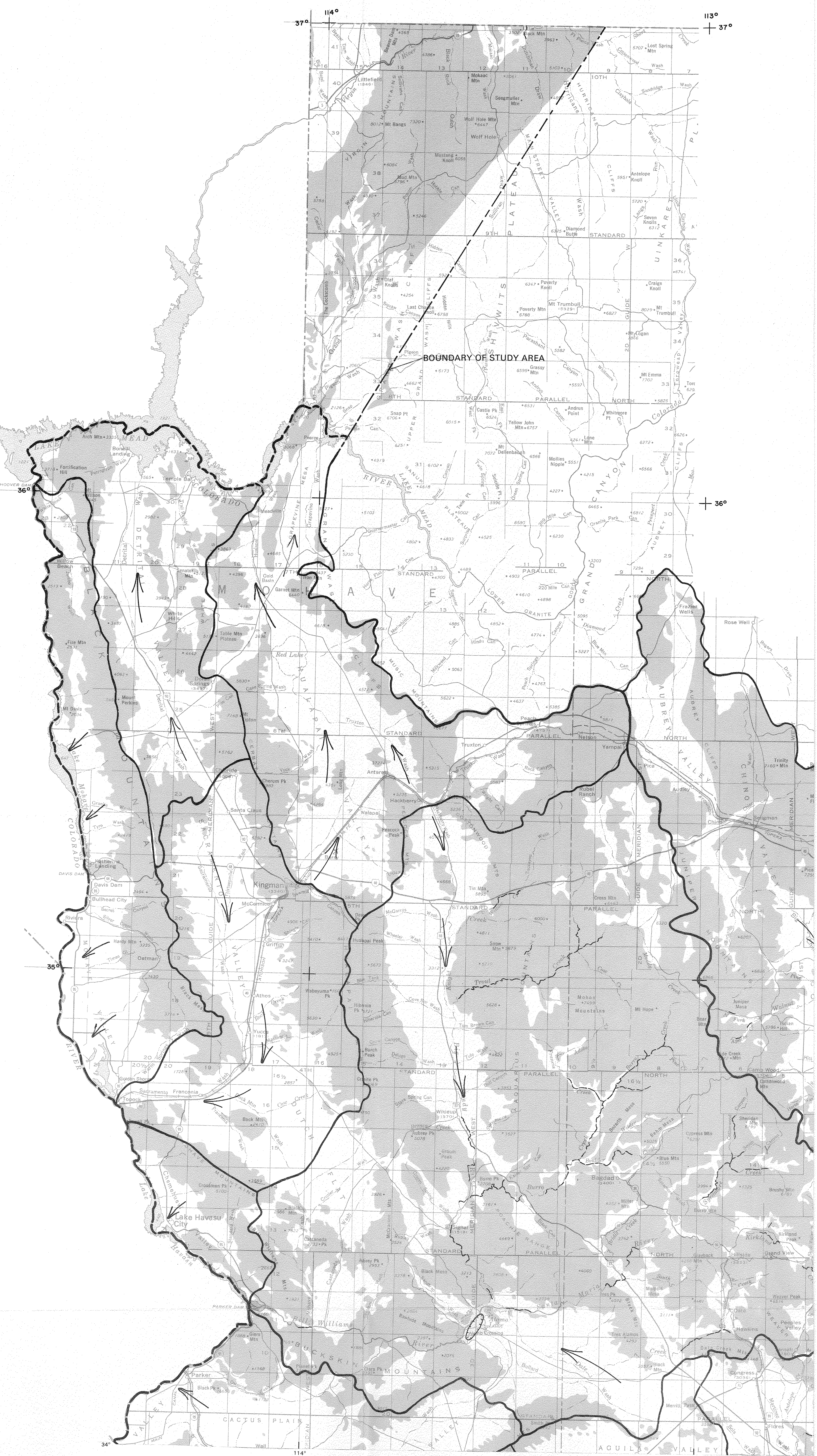
GAINING STREAM.--A stream that receives ground-water discharge

AREA WHERE GROUND-WATER DISCHARGE OCCURS BY EVAPOTRANSPIRATION AND TO SEEPS, SPRINGS, PLAYAS, AND LAKES

WATER-LEVEL DEPRESSION.--Caused by ground-water withdrawal. Hachures shown on low side of depression

GENERAL DIRECTION OF GROUND-WATER FLOW AT THE WATER TABLE

AREAS UNDERLAIN BY CONSOLIDATED ROCK.--Unshaded areas within study area are underlain by basin fill



MAP SHOWING GROUND-WATER UNITS

Scale 1:500,000

1 inch equals approximately 8 miles

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

Base from U.S. Geological Survey
State base map, 1979

MAPS SH

Prepared in cooperation with the
ARIZONA BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY and the
ARIZONA DEPARTMENT OF WATER RESOURCES

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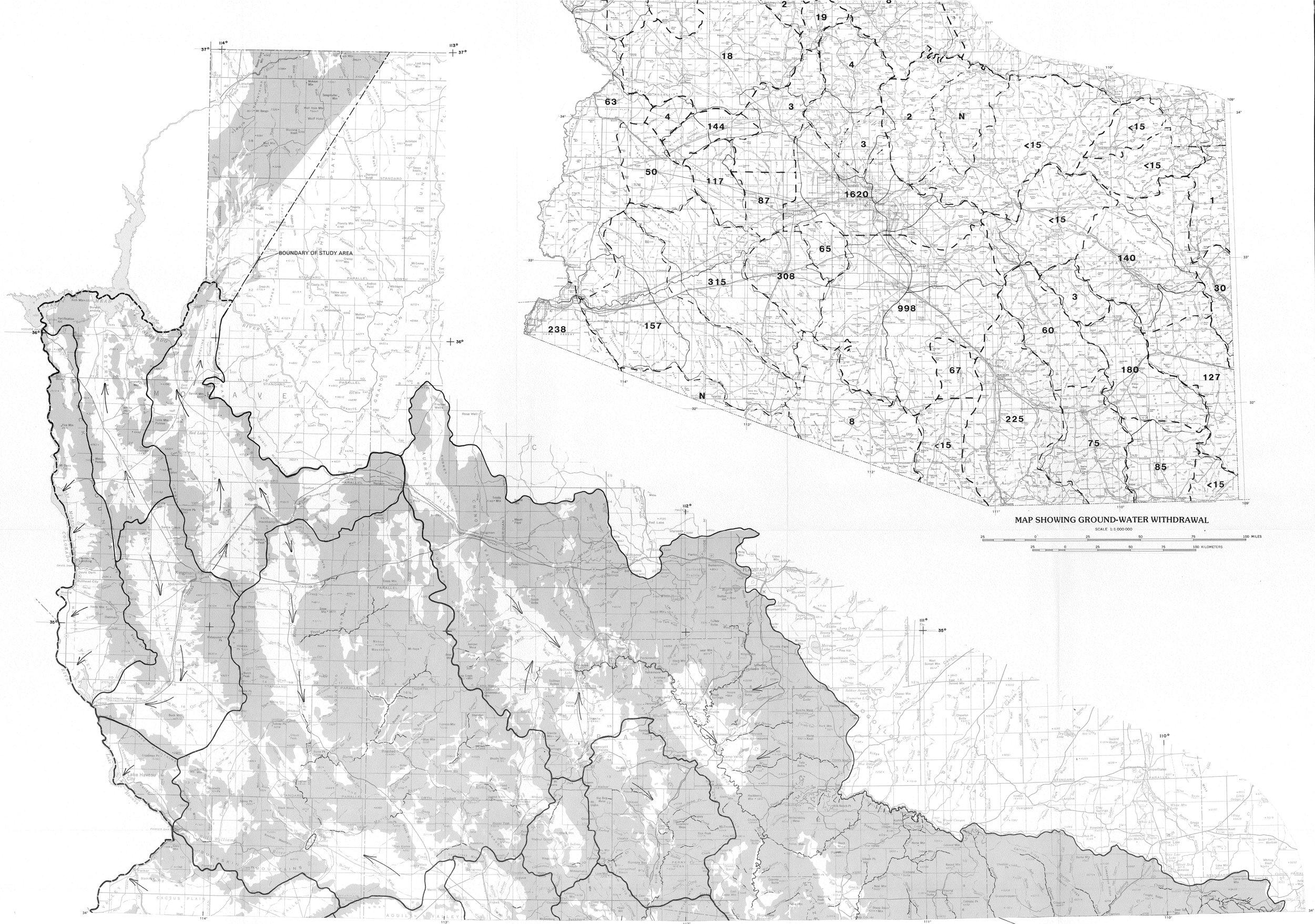

MAP SHOWING GROUND-WATER WITHDRAWAL

SCALE 1:1,000,000

MAP SHOWING GROUND-WATER UNITS

Scale 1:500,000

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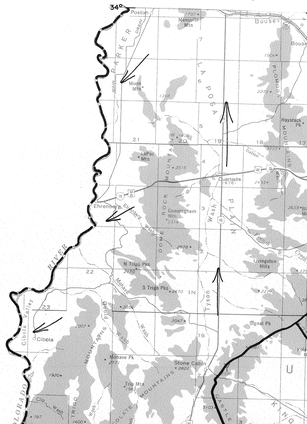
IN MOUNTING, OVERLAP TO LINE



MAP SHOWING STUDY AREA IN THE BASIN AND RANGE PROVINCE AND AREA OF THIS REPORT

CONVERSION FACTORS

Multiply inch-pound unit	By	To obtain international unit
foot	0.3048	meter
mile	1.609	kilometer
acre-foot	1,233.0	cubic meter

MAP SHOWING GROUND-WATER UNITS

Scale 1:500,000
1 inch equals approximately 8 miles

10 0 10 20 30 40 Miles
10 0 10 20 30 40 50 Kilometers

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