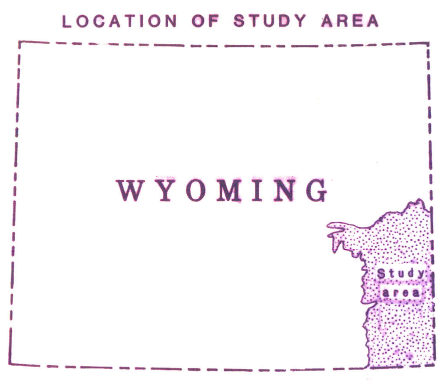
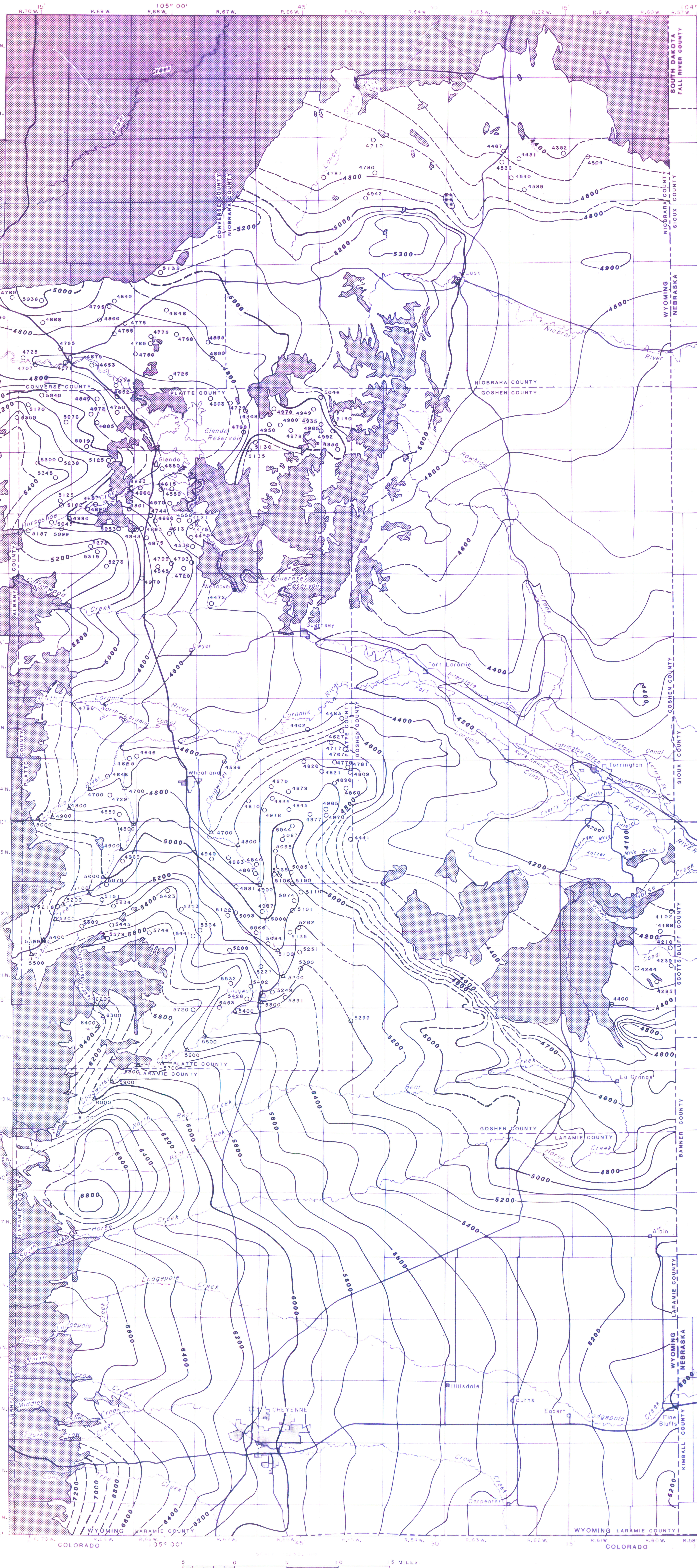
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS REPORT 84-4033





EXPLANATION

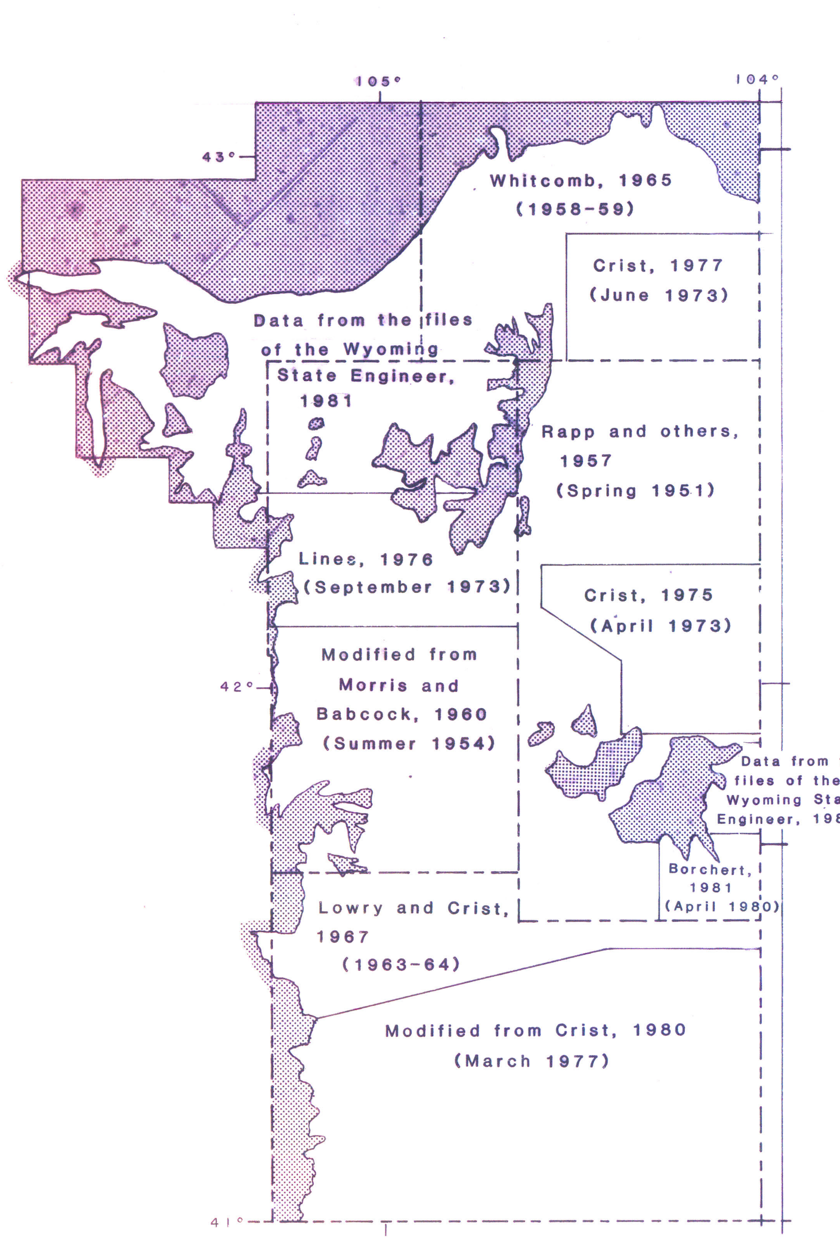
PRE-OLIGOCENE DEPOSITS--Deposits not considered a part of the High Plains aquifer in Wyoming

5200 **POTENTIOMETRIC CONTOUR**--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval 100 feet. National Geodetic Vertical Datum of 1929

4729 **WELL**--Numbers refer to altitude of water level, in feet above National Geodetic Vertical Datum of 1929

4900 **STREAM SITE**--Numbers refer to altitude of bed of perennial stream at the site, in feet above National Geodetic Vertical Datum of 1929

BOUNDARY OF HIGH PLAINS AQUIFER



INDEX TO HYDROLOGIC MAPPING--Shows source of potentiometric contours and source of data used in compiling potentiometric-surface map. (Date of data collection in parentheses)

INTRODUCTION

The U.S. Geological Survey, in 1977, began a 5-year regional study of the High Plains aquifer, which underlies 174,000 square miles in eight States (Weeks, 1978). The study area and aquifer are described by Gutentag and Weeks (1980). As part of this regional study, Survey hydrologists in each of the eight States prepared interpretive maps describing the High Plains aquifer in their respective State. These maps were compiled to provide a basis for developing a computer model of the aquifer that will predict aquifer response to changes in ground-water development for the entire region.

The purpose of this report is to provide a potentiometric-surface map of the High Plains aquifer in Wyoming and to briefly describe the geologic composition of the aquifer.

GEOLOGIC DESCRIPTION OF THE AQUIFER

The High Plains aquifer, as defined in this report, consists of one or more hydraulically connected geologic units of Oligocene or younger age and underlies an area of 8,190 square miles in southeastern Wyoming. Pre-Oligocene deposits (shaded areas on the principal map) are not considered to be part of the High Plains aquifer; these deposits consist of igneous, metamorphic, marine, and nonmarine rocks that range in age from Precambrian to Eocene. The geologic units of the High Plains aquifer in ascending order are: the White River Formation of Oligocene age, the Arikaree Formation of early Miocene age, the Ogallala Formation of late Miocene age, and alluvial deposits of Quaternary age.

The White River Formation, which is as much as 600 feet thick, primarily consists of massive siltstone containing beds of sandstone, conglomerate, and volcanic ash. The White River is considered an aquifer everywhere in Wyoming where it has sufficient saturated thickness to yield water to wells.

The Arikaree Formation, which is as much as 1,000 feet thick, is predominantly a fine-grained, massive sandstone that contains beds of siltstone, layers of hard concretionary sandstone, and thin beds of volcanic ash. A coarse conglomerate occurs at the base of this formation in some places.

The Ogallala Formation, which is as much as 300 feet thick, consists of a heterogeneous mixture of sand and gravel layers, silt and clay layers, and some thin limestone layers. The layers are cemented in some places by calcium carbonate. This formation has been eroded from much of the High Plains area in Wyoming.

Quaternary alluvium, which is as much as 200 feet thick (Crist, 1975, pl. 3), includes alluvial deposits underlying terraces and flood plains. These deposits consist of lenticular layers of sand, gravel, silt, clay, and boulders. This unit occurs primarily in major river valleys.

POTENTIOMETRIC SURFACE OF THE AQUIFER

The configuration of the potentiometric surface of the High Plains aquifer is shown on the map. The aquifer boundaries on the west and north are the limits of the geologic units comprising the High Plains aquifer. The geologic units in the east and south extend beyond Wyoming's border.

The potentiometric-surface map was compiled primarily from potentiometric-surface maps of smaller areas published in reports describing the hydrology of the aquifer in southeastern Wyoming. For those areas where no potentiometric-surface maps were available from published reports, the potentiometric contours were constructed from water-level data obtained from the files of the Office of the Wyoming State Engineer or from tabulated data in the reports listed on the index map. In areas of sparse water-level data, the altitude of the land-surface contour at the point it crosses a perennial stream was used as the water-level altitude. These points were obtained from topographic maps and are designated in the potentiometric-surface map explanation as stream sites.

The potentiometric surface is considered to be representative of the water level during 1981 for the Oligocene and younger deposits in the High Plains area. Any significant changes in water levels, which are principally due to irrigation withdrawals, have occurred in areas described by the most recent reports. These reports are Crist (1977), Borchert (1981), Crist (1980), and Lines (1976). Slight changes in water levels have occurred during the time since data for these reports were collected, however, the 1981 conditions are still represented by the potentiometric-surface contours at the contour interval used on this map.

The map shows that the potentiometric surface slopes eastward across the High Plains area. Locally, this pattern of flow is altered by ground-water discharge to streams such as occurs along the North Platte River in Goshen County and along Sybille and Chugwater Creeks in Platte County. The pattern of flow is altered in areas of ground-water divides such as occurs along the northern boundary near the Nebraska State line.

The general direction of ground-water movement is perpendicular to the potentiometric contours in the direction of slope or hydraulic gradient. The slope of the potentiometric surface ranges from about 10 feet per mile in northeastern Goshen County to about 250 feet per mile in southern Goshen County. Typically, the slope of the potentiometric surface is between 20 and 30 feet per mile. The altitude of the potentiometric surface declines from about 7,100 feet in southwestern Laramie County to about 4,100 feet along the North Platte River in eastern Goshen County.

There is little exchange of water between the pre-Oligocene deposits and the High Plains aquifer because the pre-Oligocene deposits generally have a much lower permeability. The resistant pre-Oligocene deposits, such as crystalline rocks and limestone, form topographic highs; generally, recharge areas occur where the High Plains aquifer is in contact with these rocks, such as in the north-central and most of the western parts of the area. In part of the area, however, the High Plains aquifer is not in contact with the resistant rocks but is separated from them by areas eroded down into less resistant pre-Oligocene rocks. The contact between the High Plains aquifer and the less resistant pre-Oligocene deposits may be a barrier to flow because of the low permeability of the less resistant rocks which results in steepening of the gradient, as occurs in southern Goshen County.

REFERENCES

Borchert, W. B., 1981, Water-level contours near La Grange, southeastern Wyoming and an adjacent part of Nebraska, April 30, 1980: U.S. Geological Survey Open-File Report 81-422, scale 1:48,000.

Crist, M. A., 1975, Hydrologic analysis of the valley-fill aquifer, North Platte River valley, Goshen County, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 3-75, 60 p.

—— 1977, Hydrologic evaluation of the Arikaree Formation, near Lusk; Niobrara and Goshen Counties, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 77-111, 23 p.

—— 1980, Effect of pumpage on ground-water levels as modeled in Laramie County, Wyoming: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1104, 26 p.

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Rapp, J. R., Visher, F. N., Littleton, R. T., 1957, Geology and ground-water resources of Goshen County, Wyoming: U.S. Geological Survey Water-Supply Paper 1377, 145 p.

Weeks, J. B., 1978, Plan of study for the High Plains Regional Aquifer System Analysis in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming: U.S. Geological Survey Water-Resources Investigations Report 78-70, 28 p.

Whitcomb, H. A., 1965, Ground-water resources and geology of Niobrara County, Wyoming: U.S. Geological Survey Water-Supply Paper 1788, 101 p.

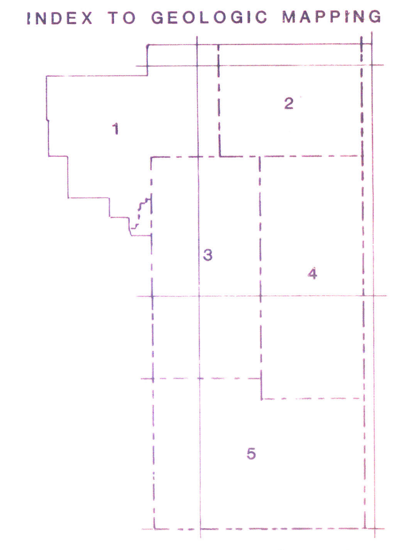
CONVERSION FACTORS AND VERTICAL DATUM

For use of readers who prefer to use metric units, conversion factors for inch-pound units used in this report are listed below:

Multiply	By	To obtain
foot	0.3048	meter
mile	1.609	kilometer
foot per mile	.1894	meter per kilometer
square mile	2.590	square kilometer

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level.

INDEX TO GEOLOGIC MAPPING



1-Love and others (1955)
2-Whitcomb (1965)
3-Morris and Babcock (1960)
4-Rapp and others (1957)
5-Lowry and Crist (1967)

For additional information write to:
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Copies of this map can be purchased from:
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GENERALIZED POTENTIOMETRIC-SURFACE MAP OF THE HIGH PLAINS AQUIFER IN WYOMING, 1981

By
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1984