PREPARED IN COOPERATION WITH THE
COLORADO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER RESOURCES,
OFFICE OF THE STATE ENGINEER; THE DENVER BOARD OF WATER COMMISSIONERS;
AND ADAMS, ARAPAHOE, DOUGLAS, ELBERT, AND EL PASO COUNTIES

HYDROLOGIC CONDITIONS

Most precipitation that falls on the earth's surface runs off in streams and creeks, is evaporated from the soil surface, or is consumed by vegetation. In addition, a small part of the precipitation usually percolates to depth and replenishes the ground-water supply. This is the process by which the Dawson aquifer receives recharge. As shown on the adjacent diagram of ground-water movement (fig. 6), the highland areas between stream channels are the principal recharge areas. Most water moves laterally through the conglomerate and sandstone beds from areas of recharge toward areas of discharge. This can occur on both a local and regional scale. On a local scale, water moves from the highland recharge areas through the upper part of the aquifer to the discharge areas in nearby stream valleys, while on a regional scale, water moves from highland areas into deeper parts of the aquifer and discharges into more remote stream valleys. In the stream valleys, water from the Dawson aquifer discharges into streams, into the alluvial aquifers along the stream channels, or is consumed by vegetation growing in the valleys. Although most of the water in the Dawson aquifer moves laterally through the aquifer, some water discharges by moving downward from the Dawson aquifer into the underlying Denver aquifer. In addition to these long-standing processes of natural discharge, relatively recent discharge is occurring from pumping wells. In areas where pumping has caused significant water-level declines, natural discharge may no longer occur and pumpage may be the only form of ground-water discharge.

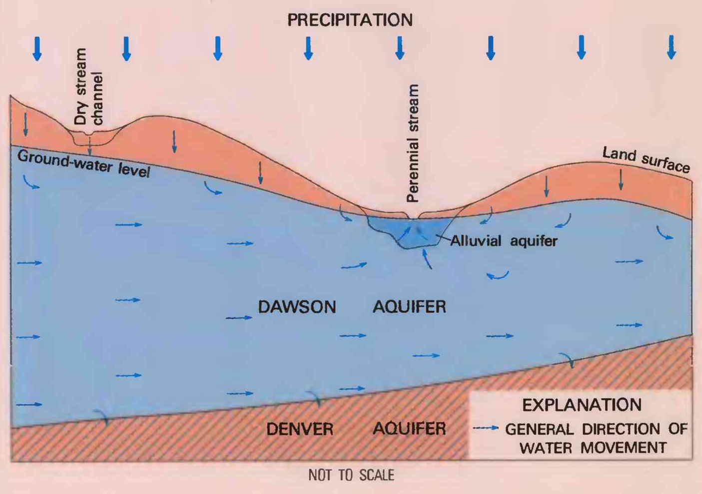

FIGURE 6.—DIAGRAM OF GROUND-WATER MOVEMENT

Perennial streams that are cut into the Dawson Arkose may be supplemented either directly or indirectly by ground-water discharge from the Dawson aquifer. Streamflow is directly supplemented by springs and seeps that occur as a result of natural discharge of water from the Dawson aquifer at the land surface. Streamflow is indirectly supplemented where water from the Dawson aquifer first discharges into alluvial aquifers and the water in the alluvial aquifer in turn discharges into the stream.

The 1978 potentiometric surface map (fig. 7) shows the elevation of the standing-water level during 1978 in wells completed in the Dawson aquifer. The elevation of the potentiometric surface ranged from a high of 7,500 feet in the area near Black Forest to a low of 5,500 feet near Englewood. Water in the aquifer moves from points of higher water-level elevation to points of lower water-level elevation along paths that are perpendicular to the potentiometric contours shown on the map. The arrows on the map indicate the general direction of this water movement. The relatively sharp bends in the potentiometric contours near some streams are the result of water moving from the aquifer into the stream valleys. The ridge in the potentiometric surface located near a line from Palmer Lake to Rattlesnake Butte forms a ground-water divide. Ground water north of the divide moves in a northerly direction while ground water south of the divide moves in a southerly direction.

The elevation of the potentiometric surface and the direction of water movement are controlled primarily by the elevation of the stream channels in the area, the hydrologic properties of the aquifer, and the magnitude and distribution of precipitation. This occurs because the rate of precipitation recharge to the Dawson aquifer generally exceeds the ability of the aquifer to transmit water over long distances. The excess ground water is discharged to nearby streams allowing the elevation of the stream channels to affect the elevation of the potentiometric surface and the direction of ground-water movement. As a result of this condition, the areas with the highest land surface elevation (near the Black Forest, for example) also have the highest potentiometric surface elevation. In addition, more water is available for recharge in these high areas because more precipitation generally occurs at the higher elevations. However, because precipitation recharge occurs throughout the Dawson aquifer, no single geographic area can be considered to be "the recharge area" for the aquifer.

Water-level measurements made between 1956 and 1960 in wells completed in the aquifer were used to estimate the 1958 potentiometric surface. These data were adequate to define the surface only in the northwestern part of the area, as shown on the adjacent map (fig. 8). The direction of ground-water movement in 1958 was similar to the direction of movement during 1978 and the effects of Plum Creek and Cherry Creek on the 1958 potentiometric surface are apparent. The difference in potentiometric surface elevations between 1958 and 1978 is the change in water level that has occurred in the aquifer during the 20 year period (fig. 9). In most of the northwestern part of the aquifer, water-level changes have ranged from 50 feet of rise to 50 feet of decline. However, water-level declines near Castle Rock and Parker have exceeded 100 feet and near Cherry Creek Reservoir declines have exceeded 200 feet. The 1958–78 water-level change data from wells at a few scattered locations in other parts of the Dawson aquifer generally show water-level rises or declines of less than 30 feet with no consistent pattern in these areas.

Wells completed in the Dawson aquifer generally yield from 0.1 to 1.0 gallon per minute per foot of drawdown. Therefore, if the water level in a well declines 100 feet while the pump is operating, the well probably would yield between 10 and 100 gallons per minute. Three geologic factors that affect the yield of a well are: (1) The thickness of water-yielding material penetrated by the well, (2) the permeability of the material, and (3) the distance the water level in the well can be drawn down while the pump is operating. Thus, a well completed in a large thickness of permeable sandstone at sufficient depth to allow a significant water-level drawdown while pumping would yield more water than a well completed in a thin, less permeable, sandstone that has a water level near the base of the sandstone.

METRIC CONVERSION FACTORS

The inch-pound units used in this report may be converted to metric units by use of the following conversion factors:

To convert inch-pound units	Multiply by	To obtain metric units
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
gallon per minute	0.06309	liter per second
gallon per minute per foot	0.2070	liter per second per meter

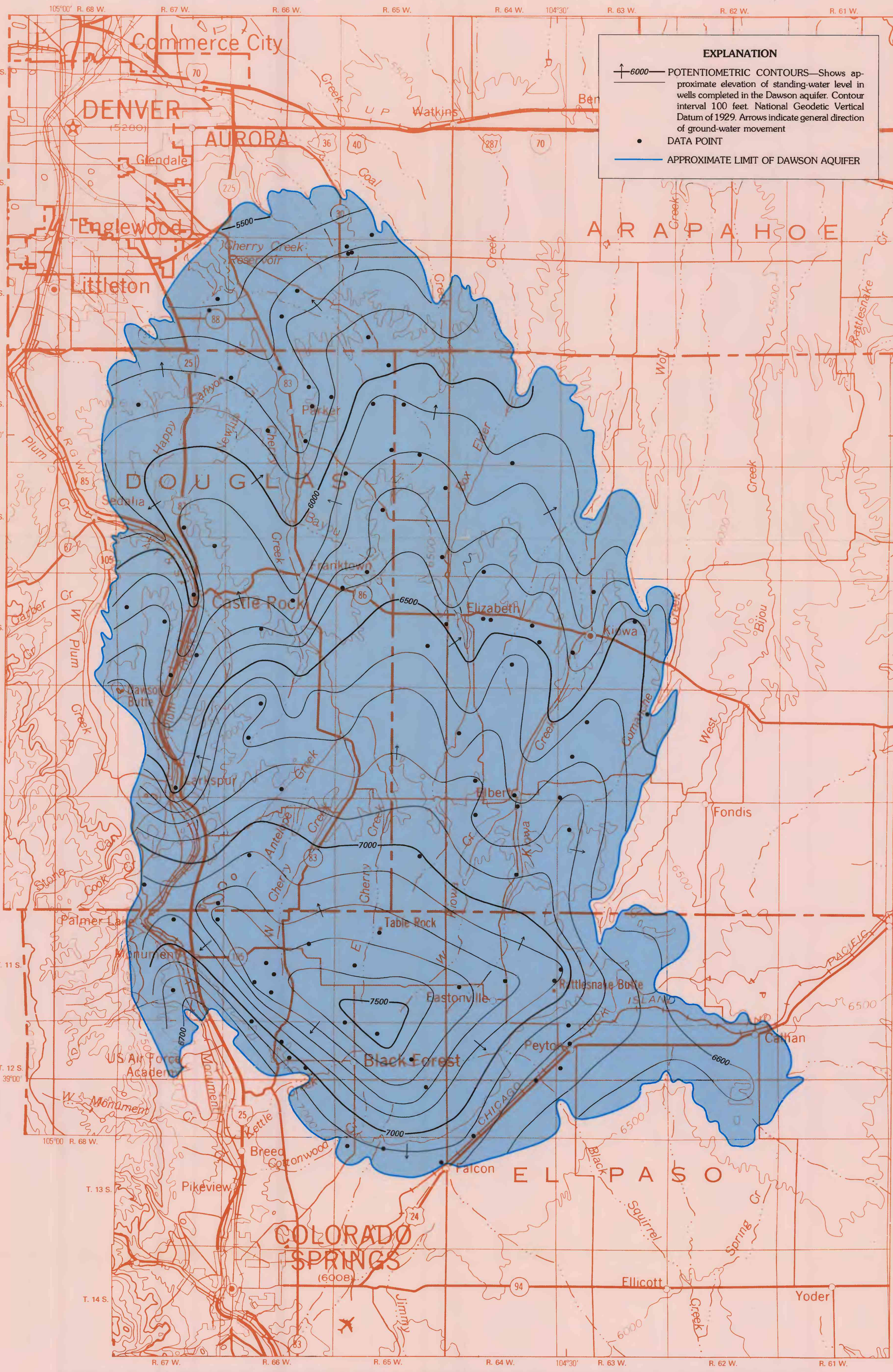

FIGURE 7.—MAP SHOWING ELEVATION OF POTENTIOMETRIC SURFACE IN THE AQUIFER, 1978

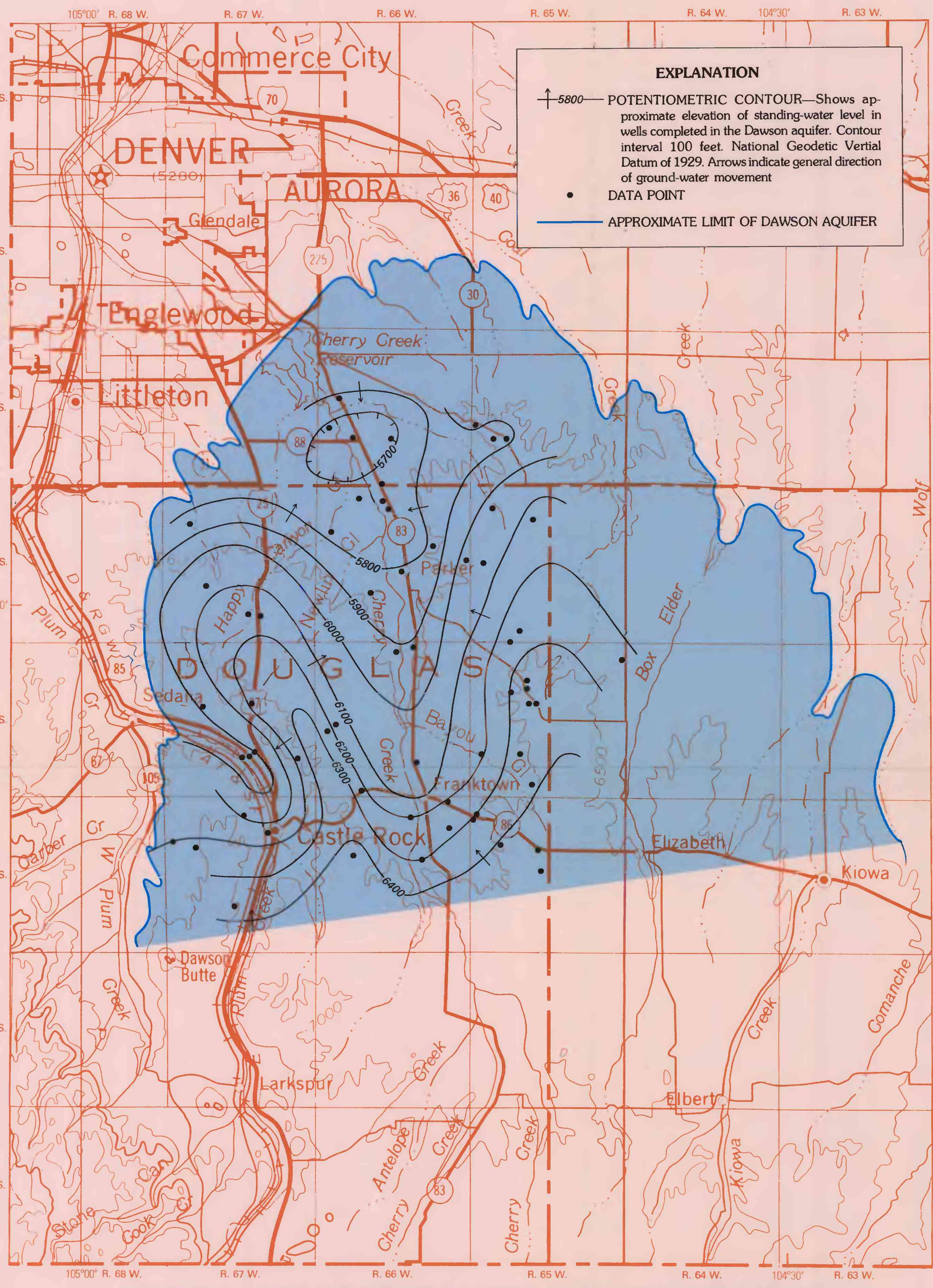

FIGURE 8.—MAP SHOWING ELEVATION OF POTENTIOMETRIC SURFACE IN THE AQUIFER, 1958

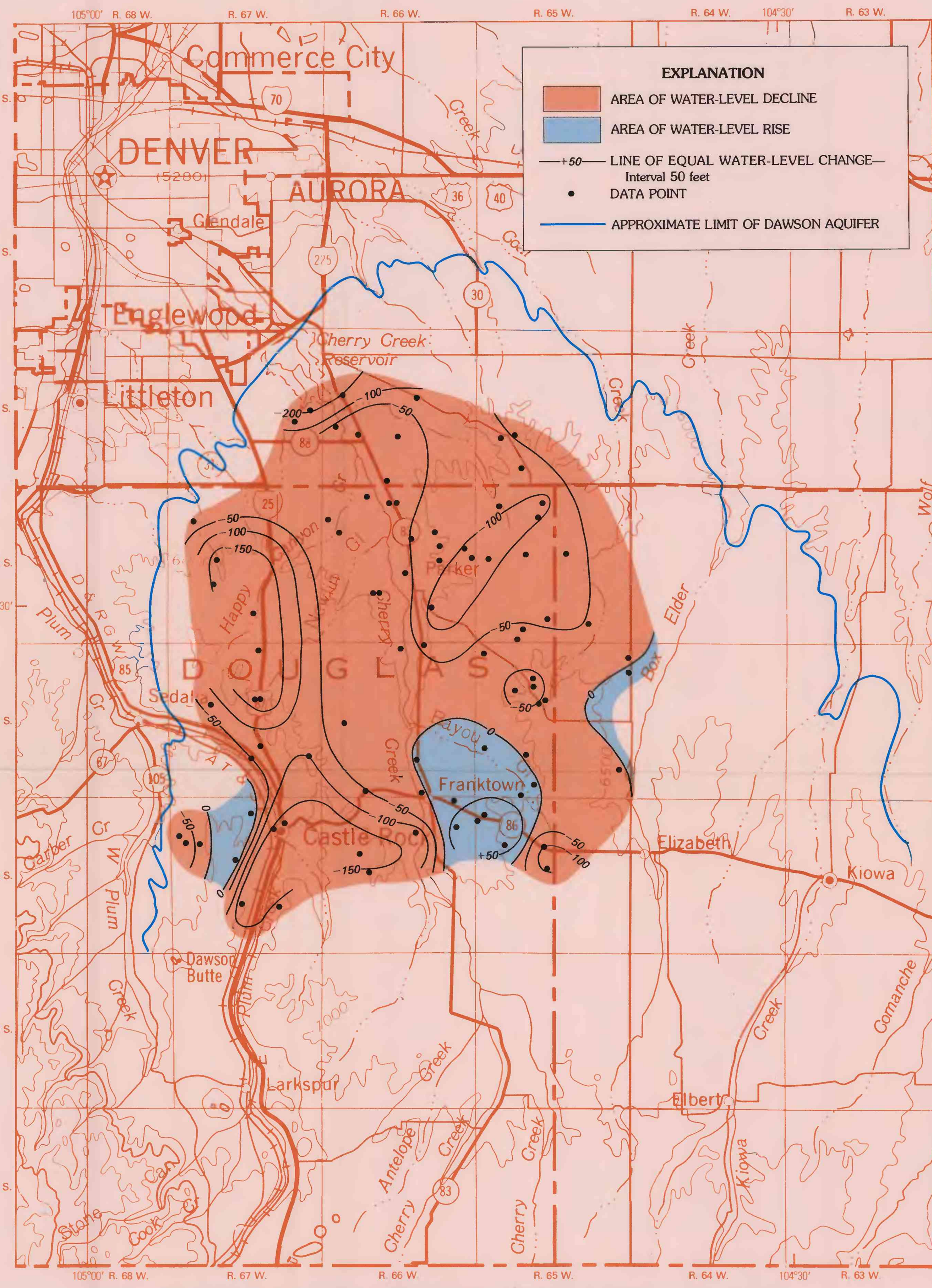

FIGURE 9.—MAP SHOWING WATER-LEVEL CHANGES IN THE AQUIFER BETWEEN 1958 AND 1978

Base from U.S. Geological Survey 1:500,000 state base map, 1969

SCALE 1:250 000
5 0 5 10 15 20 25 MILES
5 0 5 10 15 20 25 KILOMETERS
CONTOUR INTERVAL 500 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1981—W81045

GEOLOGIC STRUCTURE, HYDROLOGY, AND WATER QUALITY OF THE DAWSON AQUIFER IN THE DENVER BASIN, COLORADO

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1981