PREPARED IN COOPERATION WITH THE
COLORADO DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER RESOURCES, and the
COLORADO WATER CONSERVATION BOARD

Outcrop and Subcrop

North of Boulder, the outcrop and subcrop of the Laramie–Fox Hills aquifer (figs. 2, 3, and 4) were defined by use of structural contour maps of the top and base of the Laramie–Fox Hills aquifer, topographic maps of the land surface, and paleotopographic maps of the contact between the alluvium and the underlying bedrock (Robson, 1996). In upland areas where overburden is thin or absent, the outcrop of the Laramie–Fox Hills aquifer was defined by the intersection of the structural surfaces with the topographic surface. The intersection of the top of the aquifer with land surface defines the eastern edge of the outcrop; the intersection of the base of the aquifer with land surface defines the western edge of the outcrop. In valleys where the alluvium is thick and saturated, the subcrop of the Laramie–Fox Hills aquifer under the alluvium is defined by the intersection of the structural surfaces with the bedrock paleotopographic surface. The intersection of the top of the aquifer with the paleotopography defines the eastern edge of the subcrop; the intersection of the base of the aquifer with the paleotopography defines the western edge of the subcrop.

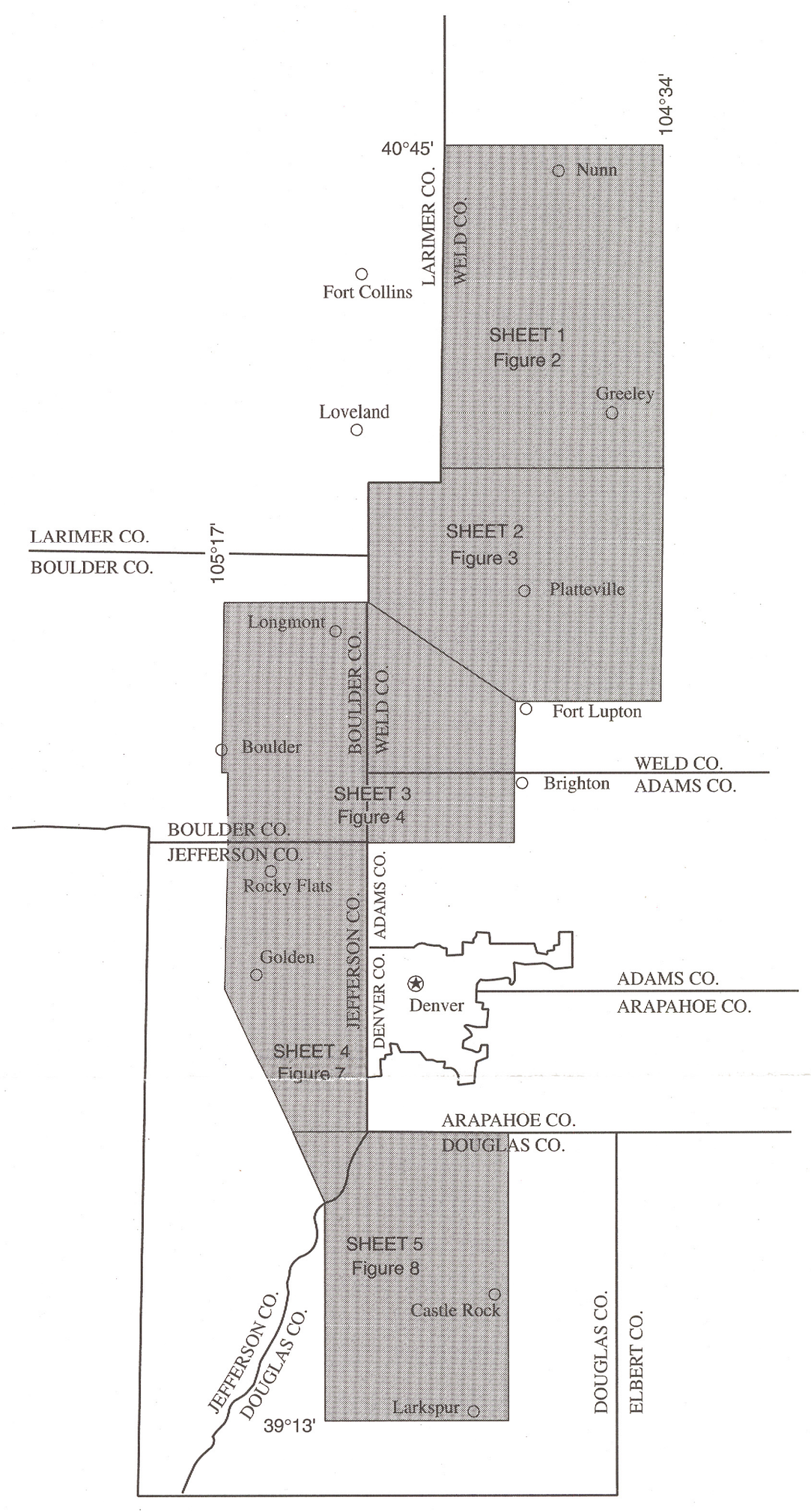
The Laramie–Fox Hills aquifer outcrops shown in figures 2, 3, and 4 are in good agreement with existing geologic mapping (Briscoe, 1972; Hershey and Schneider, 1972; Trimble, 1975; Colton and Anderson, 1977; Colton, 1978). The aquifer outcrops are within the interval from the upper part of the Pierre Shale transition zone to the lower part of the Laramie Formation as defined from mapped outcrops. The aquifer outcrops are not always in agreement with inferred geologic contacts in areas where the bedrock is concealed by thick overburden. However, the inferred contacts are of questionable accuracy in these areas. The aquifer outcrops are in an area of shallow eastward-dipping beds, range in width from about 1 to 12 miles, and are irregular primarily because of the effects of varied topography.

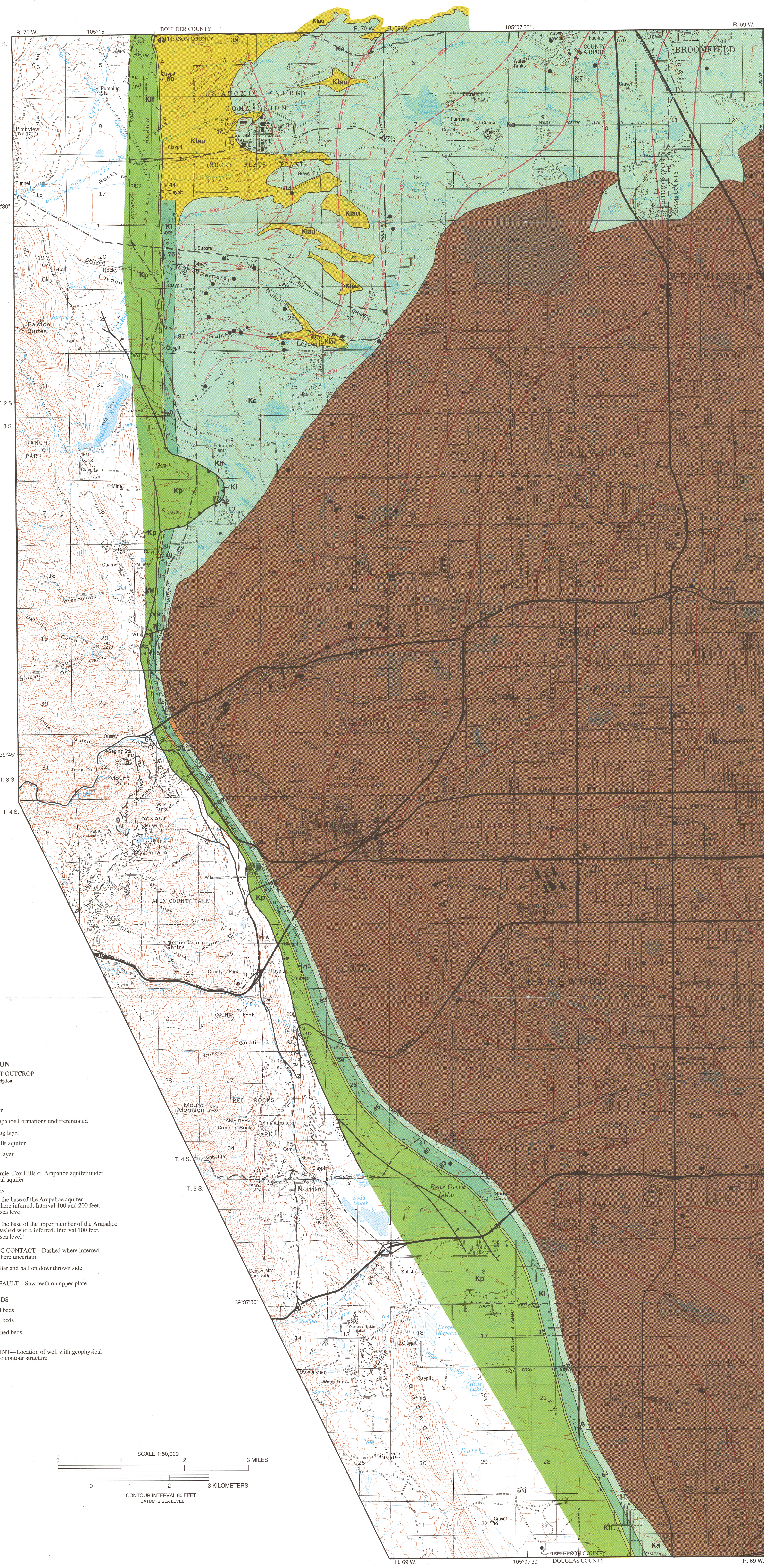
Extensive areas of subcrop are present along the South Platte, Cache La Poudre, and Big Thompson Rivers, and Saint Vrain and Boulder Creeks. In these areas, the Laramie–Fox Hills aquifer is in direct hydraulic connection with water in the alluvium and is indirectly connected with the streams through the alluvium. Hydraulic heads in the streams and in the alluvium affect the head in the Laramie–Fox Hills aquifer by providing recharge to the bedrock aquifer or accepting discharge from the bedrock aquifer.

South of Boulder, faulting and orogenic deformation have produced steeply dipping to overturned beds in the western margin of the Denver Basin aquifers (figs. 7 and 8). Steeply dipping beds coupled with generally thin overburden in this area have enabled more precise geologic mapping of bedrock outcrops (Scott, 1962; Smith, 1964; Van Horn, 1972). In Douglas County (fig. 8), additional field mapping was undertaken to revise and update parts of geologic maps by Scott (1963), and Trimble and Machette (1979a and b). These published maps and the revised geologic maps were used to define the outcrop and subcrop of the Laramie–Fox Hills, Arapahoe, Denver, and Dawson aquifers south of Boulder (figs. 7 and 8), except in the Rocky Flats–Leyden area.

In the Rocky Flats–Leyden area, the outcrop of the base of the upper member of the Arapahoe aquifer is concealed by an extensive mantle of Tertiary Rocky Flats Alluvium and Quaternary colluvium. This basal outcrop was mapped by intersection of the structure of the base of the upper member with the bedrock paleotopography in a procedure similar to that used for the Laramie–Fox Hills aquifer north of Boulder. Although the Rocky Flats Alluvium is as much as 90 feet thick and is a local aquifer, the Arapahoe under the alluvium was mapped as outcrop rather than subcrop because the overlying alluvial aquifer is perched and of local extent. The outcrop of the Arapahoe aquifer in the Rocky Flats–Leyden area is extensive because of the small eastward dip of the beds, but the outcrop becomes a narrow band southwest of Leyden where dips increase near the basin margin. Shales of the undifferentiated middle and lower Arapahoe Formation or upper Laramie Formation are exposed through the upper member structure in the valleys of several streams that cross the outcrop.

Bedrock aquifer outcrops south of Leyden generally form narrow north-south trending bands because of the steep dip of bedding. Outcrops are offset or faulted out in some areas by displacement on faults that cut the trend of the outcrop. The width of the subcrops is limited by the width of the outcrops, and narrow bands of subcrop of Laramie–Fox Hills and Arapahoe aquifers are indicated near Clear Creek and the South Platte River (figs. 7 and 8). Near Chatfield Lake (fig. 8), a more extensive Arapahoe subcrop is present under the lake and the adjacent alluvial aquifer because of a wider Arapahoe outcrop in this area.





EXPLANATION

GEOHYDROLOGIC UNIT OUTCROP
See Table 1 for additional description

- TKd — Denver aquifer
- Ka — Arapahoe aquifer
- Klau — Laramie and Arapahoe Formations undifferentiated
- Kl — Laramie confining layer
- Klf — Laramie–Fox Hills aquifer
- Kp — Pierre confining layer
- S — Subcrop of Laramie–Fox Hills or Arapahoe aquifer under principal alluvial aquifer

STRUCTURE CONTOURS

- 5000 — Altitude of the base of the Arapahoe aquifer. Dashed where inferred. Interval 100 and 200 feet. Datum is sea level
- 5400 — Altitude of the base of the upper member of the Arapahoe aquifer. Dashed where inferred. Interval 100 feet. Datum is sea level

GEOLOGIC CONTACT—Dashed where inferred, queried where uncertain

FAULT—Bar and ball on downthrown side

THRUST FAULT—Saw teeth on upper plate

STRIKE AND DIP OF BEDS

- 30 — Inclined beds
- Vertical beds
- 73 — Overturned beds

DATA POINT—Location of well with geophysical log used to contour structure

SCALE 1:50,000
0 1 2 3 MILES
0 1 2 3 KILOMETERS
CONTOUR INTERVAL 80 FEET
DATUM IS SEA LEVEL

Base from U.S. Geological Survey 1:50,000 County map for Jefferson County

FIGURE 7. Structure, outcrop, and subcrop of the Arapahoe aquifer in the Golden area

STRUCTURE, OUTCROP, AND SUBCROP OF THE BEDROCK AQUIFERS ALONG THE WESTERN MARGIN OF THE DENVER BASIN, COLORADO

by
S.G. Robson, George Van Slyke, and Glenn Graham

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