



EXPLANATION

DISSOLVED-SOLIDS CONCENTRATION IN WATER FROM UNCONSOLIDATED ALLUVIAL DEPOSITS, IN MILLIGRAMS PER LITER

Less than 500
Greater than 500
Line pattern indicates dissolved-solids concentration estimated

AREA WHERE DISSOLVED-SOLIDS CONCENTRATIONS IN WATER FROM UNCONSOLIDATED ALLUVIAL DEPOSITS WERE NOT MAPPED BECAUSE WELL YIELDS PROBABLY CANNOT BE SUSTAINED THROUGHOUT THE YEAR

AREA WHERE DISSOLVED-SOLIDS CONCENTRATIONS GENERALLY ARE GREATER THAN 500 MILLIGRAMS PER LITER IN WATER FROM CULLUVIAL, LANDSLIDE, AND DEBRIS FLOWS, AND FROM UPPER WEATHERED AND FRACUTED ZONE OF CONSOLIDATED SEDIMENTARY ROCKS

AREA WHERE DISSOLVED-SOLIDS CONCENTRATIONS GENERALLY ARE LESS THAN 500 MILLIGRAMS PER LITER IN WATER FROM FRACTURED CRYSTALLINE ROCKS

CONTACT BETWEEN UNCONSOLIDATED ALLUVIAL DEPOSITS AND OTHER DEPOSITS AND ROCKS.—Dashed where approximately located

EASTERN OUTCROP LIMIT OF FRACTURED CRYSTALLINE ROCKS

WATER CHEMICAL QUALITY OF WATER DETERMINED—
First four numbers in your water were analyzed, second number is dissolved-solids concentration, in milligrams per liter; third number is total hardness, in milligrams per liter; shown only when hardness was 1800 milligrams per liter or less. Letters following numbers indicate the type of water and the unconsolidated alluvial deposits. CS=consolidated sedimentary rocks; F=fractional crystalline rocks; W=windblown deposits. Chemical symbols indicate dissolved constituents that exceeded the State standards for public-water supplies (Colorado Department of Health, 1971 and 1977).

F=nitrate; Mn=manganese; Mg=magnesium; N=nitrite plus nitrate as nitrogen; Se=selenium; SO4=sulfate

CS-4 or Cl W=windblown selected chemical constituents in water determined—Letters indicate source of water if other unconsolidated alluvial deposits: CS=consolidated sedimentary rocks; F=fractional crystalline rocks; W=windblown deposits. Number of letters refer to tabulation below. Indicate dissolved-solids concentrations, in milligrams per liter, based on a correlation between specific conductance and dissolved-solids concentration developed by L. L. Cain (written communication, 1977) for ground water in Boulder County:

1=less than 500 3=1000 to 3000
2=500 to 1000 4=greater than 3000

Chemical symbols indicate dissolved constituents that exceeded the State standards for public-water supplies (Colorado Department of Health, 1971 and 1977). Cl=chloride
N=nitrate plus nitrite as nitrogen

¹Dissolved-solids concentrations generally less than 500 milligrams per liter in water from localized areas of unconsolidated alluvial deposits (not shown) map occurs in stream valleys traversing fractured crystalline rocks.

CHEMICAL QUALITY OF WATER

The concentration of dissolved solids was the principal criterion used in this investigation to determine the suitability of ground water for urban development. Water containing 500 mg/L or less of dissolved solids generally is suitable for uses associated with urban development. However, certain constituents and individual water constituents, values of specific physical properties, amounts of radioactivity, and numbers of fecal-coliform bacteria in the water may cause the water to be unsuitable for a particular use. In addition to dissolved solids, concentrations of dissolved iron, fluoride, manganese, magnesium, and calcium, and certain selected sulfates, sulfate, and hardness, were used in this study to indicate the chemical suitability of ground water.

Ground water containing more than 500 mg/L of dissolved solids is suitable for only limited uses associated with urban development as illustrated by the example given in the section RELEVANCE TO URBAN PLANNING. As dissolved-solids concentrations increase, the possible uses in urban development decrease.

The dissolved-solids concentrations of water from water-table aquifers are shown on the chemical quality map. The following are the concentrations of constituents of concern for urban development as shown in the table. The effects of these constituents in concentrations exceeding the standards for public-water supplies are listed below and are summarized from publications of the Colorado Department of Health (1971) and the U.S. Environmental Protection Agency (1976, 1977).

For the data collected, a summary of those constituents that could affect the chemical quality of water for urban development is shown in the table. The effects of these constituents in concentrations exceeding the standards for public-water supplies are listed below and are summarized from publications of the Colorado Department of Health (1971) and the U.S. Environmental Protection Agency (1976, 1977).

METRIC CONVERSIONS

Multiple Bq To obtain
mille 1.609 kilometer
gallon per minute 0.0609 liter per second

Summary of selected chemical constituents in water from wells
[mg/L=milligrams per liter; μ g/L=micrograms per liter; 1 milligram per liter=1,000 micrograms per liter]

Constituent	Units	Unconsolidated alluvial deposits		Consolidated sedimentary rocks and windblown deposits		Fractured crystalline rocks	
		Range	Number of samples	Range	Number of samples	Range	Number of samples
Dissolved solids	mg/L	50-6,570	19	220-2,993	19	12-2,026	39
Dissolved arsenic	μ g/L	100-1,670	89	0	2	210-320	3
Dissolved chloride	mg/L	250-4,100	295	2	2	5-200	39
Dissolved fluoride	mg/L	1.8-14,000	145	12-1,200	16	2-1,200	2
Dissolved iron	μ g/L	100-15,000	164	15-1,200	17	2-60,000	3
Dissolved manganese	μ g/L	150-1,920	92	14-1,410	16	3-1,160	3
Dissolved magnesium	mg/L	125-1,610	170	30	5	11-82	4
Dissolved calcium	mg/L	None	31-3,540	177	17	120-800	4

¹Recommended State standards for public-water supplies (Colorado Department of Health, 1971); with exception of magnesium, standards are the same as the recommended Federal standards established for public-water supplies (U.S. Environmental Protection Agency, 1976).

²Primary (mandatory) State standards for public-water supplies (Colorado Department of Health, 1977); standards are the same as the mandatory Federal standards established for public-water supplies (U.S. Environmental Protection Agency, 1976); standard for fluoride based on annual average of maximum daily air temperatures in the study area.

EXPLANATION

The dissolved water is affected by dissolved solids, chloride, iron, and manganese, and a bitter metallic taste to the water; iron and manganese may impart a salty or metallic taste to the water and to beverages made with the water.

Drilled wells, stained laundry and porcelain fixtures, and increased plumbing are caused by iron and manganese. Increased plumbing also is caused by dissolved solids and excessive hardness. In addition, excessive hardness may reduce the "life" of hot-water heaters and increase the quality of water used for baths and laundry.

Water containing dissolved solids and chloride may have a laxative effect on people who are unaccustomed to drinking the water. However, this condition should be considered use of the water.

Fluoride, while generally beneficial to health, can be health hazards.

White fluoride is known to reduce dental cavities; concentrations greater than 1.8 mg/L may cause mottling of teeth, especially in children. Concentrations of nitrates, nitrite as nitrogen, 10 mg/L, are considered safe for drinking water. Concentrations of nitrate plus nitrite as nitrogen in the study area are greater than 10 mg/L, usually indicate contamination from septic-tank systems, barnyards, corrals, or commercial fertilizer use. Concentrations of selenium greater than 10 mg/L may cause selenium poisoning in sheep. "Allali" disease that affects livestock is caused by selenium.

LIMITATIONS OF THE INVESTIGATION

Well-yield data are few where the unconsolidated alluvial aquifers are known to contain water with less than 500 mg/L of dissolved solids. Therefore, potential development of the aquifer for urban, agricultural, domestic, or commercial purposes may be limited.

A comprehensive hydrogeologic investigation of the geological and hydrologic characteristics of the aquifers would be useful to adequately evaluate the potential of the aquifers for the intended uses. Also, all parameters that govern the suitability of water for a particular use were not measured in this study. In addition, chemical constituents not included in this report, concentrations of trace elements, such as barium, cadmium, chromium, copper, lead, mercury, silver, uranium, and zinc, as well as concentrations of certain pesticides, amounts of radioactivity, numbers of fecal-coliform bacteria, and the concentration or values of ammonia, color, total organic carbon, hardness, sulfide, and turbidity, may affect the suitability of the water for various uses.

Other factors not considered in this study are the effects of alluvium, permeability, development plans, and zoning ordinances. In Colorado, instance, well permits are required for development of the aquifer. In addition, topographic and geological features, which aquifer may be obtained and the amount of water that may be pumped, is determined in part by factors other than availability and chemical quality of the water. Some factors considered in selecting well sites are the effects of the water on the environment, surface-water features, such as lakes, ponds, and wetlands, and recharge to underlying aquifers. Land-use plans and zoning ordinances also may preclude a particular type of land development even though there are adequate supplies of suitable quality water for an intended use.

SELECTED REFERENCES

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MAP I-855-J (SHEET 2 OF 2)



Map showing chemical quality of water

WELL YIELDS AND CHEMICAL QUALITY OF WATER FROM WATER-TABLE AQUIFERS IN THE BOULDER—FORT COLLINS—GREELEY AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

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