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Regional Hydrogeologic Summaries from Domestic Well-water Quality in Rural Nebraska -- Sand Hills

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Sand Hills Hydrogeologic Summary from *Domestic Well-water Quality in Rural Nebraska*

(A data-analysis report for the Nebraska Department of Health compiled by D. C. Gosselin and others, 1996)

Groundwater Region 1

Groundwater Region 1 occupies the Sand Hills area (fig. 1). The geology and groundwater resources have been described by Diffendal (1982), Bleed (1989), and Swinehart and Diffendal (1989). Except where indicated, the following hydrogeology is taken from these sources. The base of the principal groundwater-bearing units is generally the bottom of the Tertiary Ogallala Group. In the western Sand Hills, the Ogallala Group is underlain by Tertiary Arikaree and White River groups, consisting dominantly of fine-grained sediments deposited by wind (eolian) or rivers (alluvial); in the eastern Sand Hills, it is underlain by the Cretaceous Pierre Shale. Beneath the Sand Hills, the Ogallala consists mostly of fine- to medium-grained sand deposited in river environments. Interlayered with that sand are lesser amounts of siltstone, volcanic ash, and local occurrences of coarse sand and gravel. Because of its complex history of deposition and erosion, the Ogallala ranges in thickness from 100 to 800 feet. The next younger materials are river-deposited sediments--the Broadwater and Long Pine formations. These deposits have a maximum thickness of 300 feet, but average about 50 feet. After a long period of significant modification of the land surface by wind, rivers, and soil formation, wind-blown silts (loess) were deposited in the easternmost part of the Sand Hills. Following this, the deposition of sand dunes occurred. These dunes consist primarily of fine-grained, moderately well-sorted sand. (Geologic cross-sections are available by request from the Conservation and Survey Division.*)

The Ogallala Group, the Broadwater and Long Pine formations, and the dune sands are the primary sources of groundwater (table 1). These units are part of the High Plains aquifer that extends from South Dakota to Texas, underlying parts of eight states, as defined by the U.S. Geological Survey (Gutentag and Weeks, 1980; Weeks and Gutentag, 1981). The term *High Plains aquifer* is preferred to the *Ogallala aquifer* because Ogallala rocks constitute only one part of this groundwater system. The type, distribution, and thickness of these deposits, in conjunction with the relatively permeable dune sand, has resulted in a plentiful groundwater resource. The thickness of the groundwater system ranges from 200 to about 900 feet. Depth to water depends on position in the landscape; it may be 300 feet or greater under the top of a dune, whereas it may be 100 feet or less under a dry interdunal valley or at or near the surface in valleys where groundwater discharges into lakes, marshes, or subirrigated meadows. The natural quality of the groundwater is good; total dissolved solids generally are less than 200 milligrams per liter.

***Cross sections for this or other regions of the state (fig. 1—*Locations of geologic cross sections*) are available from the Conservation and Survey Division for a small fee. The report *Domestic Well-water quality in Rural Nebraska* is available from the Nebraska Department of Health and Human Services.** Photocopies are available at CSD; write: Map and Publications Sales/Conservation and Survey Division/113 Nebraska Hall/University of Nebraska-Lincoln/68588-0517; or call: (402) 472-7523.

Sources of Information

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Diffendal, R.F., 1982, Regional Implications of the Geology of the Ogallala Group of Southwestern Morrill County, Nebraska, and Adjacent Areas: Geological Society of America Bulletin, Vol. 3, pp. 964-976. *(Cont. on p. 4.)*

Conservation and Survey Division

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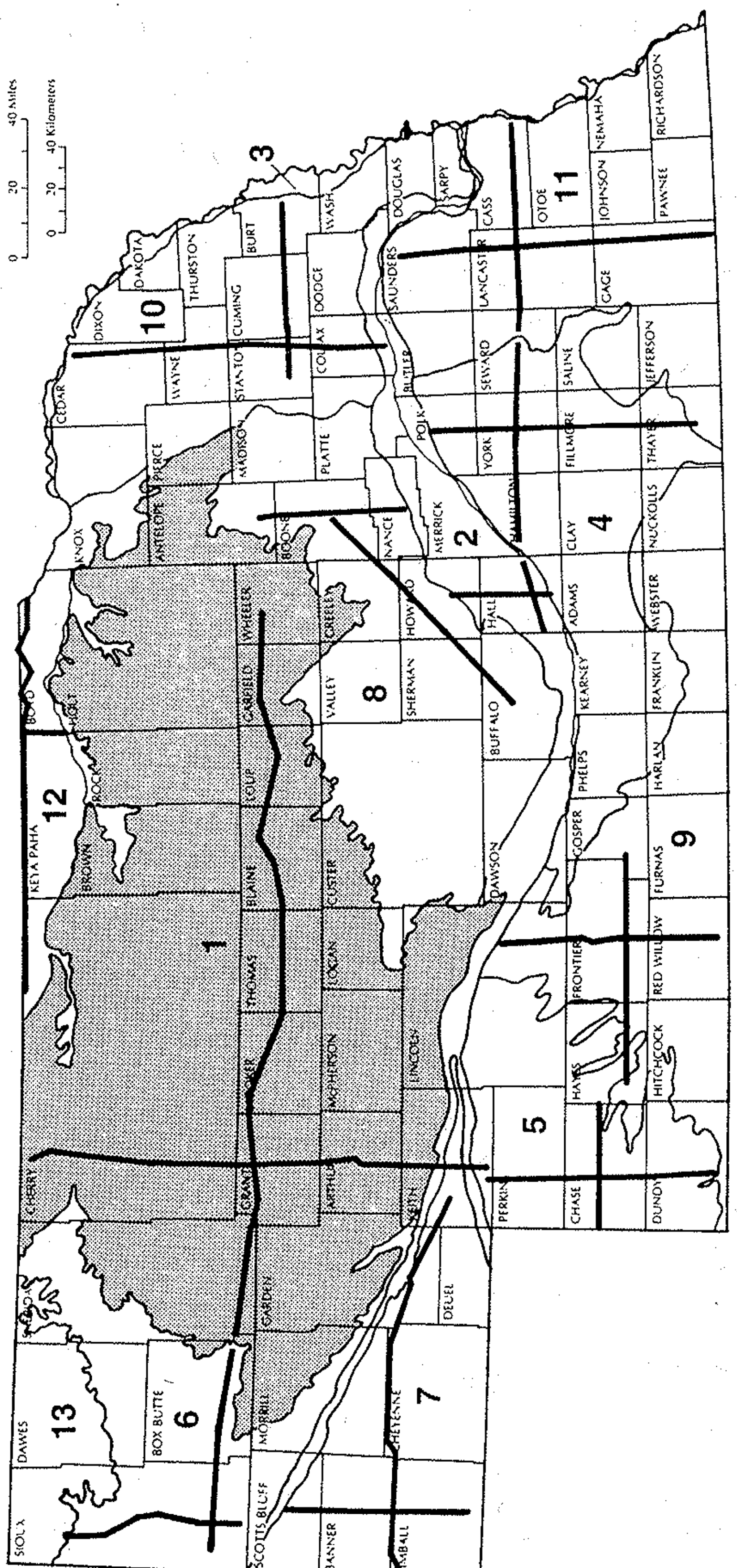

Fig. 1—Locations of geologic cross sections (Region 1 in gray)

Water-bearing Properties of Major Rock Units in Nebraska

From *The Groundwater Atlas of Nebraska* — Conservation and Survey Division, University of Nebraska-Lincoln

Era	Period	Epoch	Millions of years	Group or Formation	Lithology	Water-bearing Properties
Cenozoic	Quaternary	Holocene	0.01		Sand, silt, gravel and clay	Principal groundwater reservoir; Ogallala is absent in east and northwest. Arikaree is present primarily in west.
		Pleistocene	~2.0			
		Pliocene	5		Sand, gravel and silt	
		Miocene	24	Ogallala	Sand, sandstone, siltstone and some gravel	
		Oligocene		Arikaree	Sandstone and siltstone	
			37	White River	Siltstone, sandstone and clay in lower part	Secondary aquifer in west; water may be highly mineralized.
		Eocene	58	Rocks of this age are not identified in Nebraska.		
		Paleocene	67			
Mesozoic	Cretaceous	Late Cretaceous		Lance	Sandstone and siltstone	Generally not an aquifer; yields water to few wells in west.
				Fox Hills		
				Pierre	Shale and some sandstone in west	Generally not an aquifer; sandstones in west yield highly mineralized water to few industrial wells.
				Niobrara	Shaly chalk and limestone	Secondary aquifer where fractured and at shallow depths, primarily in east.
				Carlile	Shale; in some areas contains sandstones in upper part	Generally not an aquifer; sandstones yield water to few wells in northeast.
			98	Greenhorn-Graneros	Limestone and shale	Generally not an aquifer, yields water to few wells in east.
		Early Cretaceous	144	Dakota	Sandstone and shale	Secondary aquifer, primarily in east; water may be highly mineralized.
	Jurassic		208		Siltstone and some sandstone	Not an aquifer
	Triassic		245		Siltstone	Not an aquifer
Paleozoic	Permian		286		Limestone, dolomites, shales and sandstone.	Some sandstone, limestone and dolomites are secondary aquifers in east. Water may be highly mineralized.
	Pennsylvanian		320			
	Mississippian		360			
	Devonian		408			
	Silurian		438			
	Ordovician		505			
	Cambrian		570			
	Precambrian					

Table 1—Hydrostratigraphic chart (showing water-bearing rock units) of Nebraska Time divisions are not to scale.

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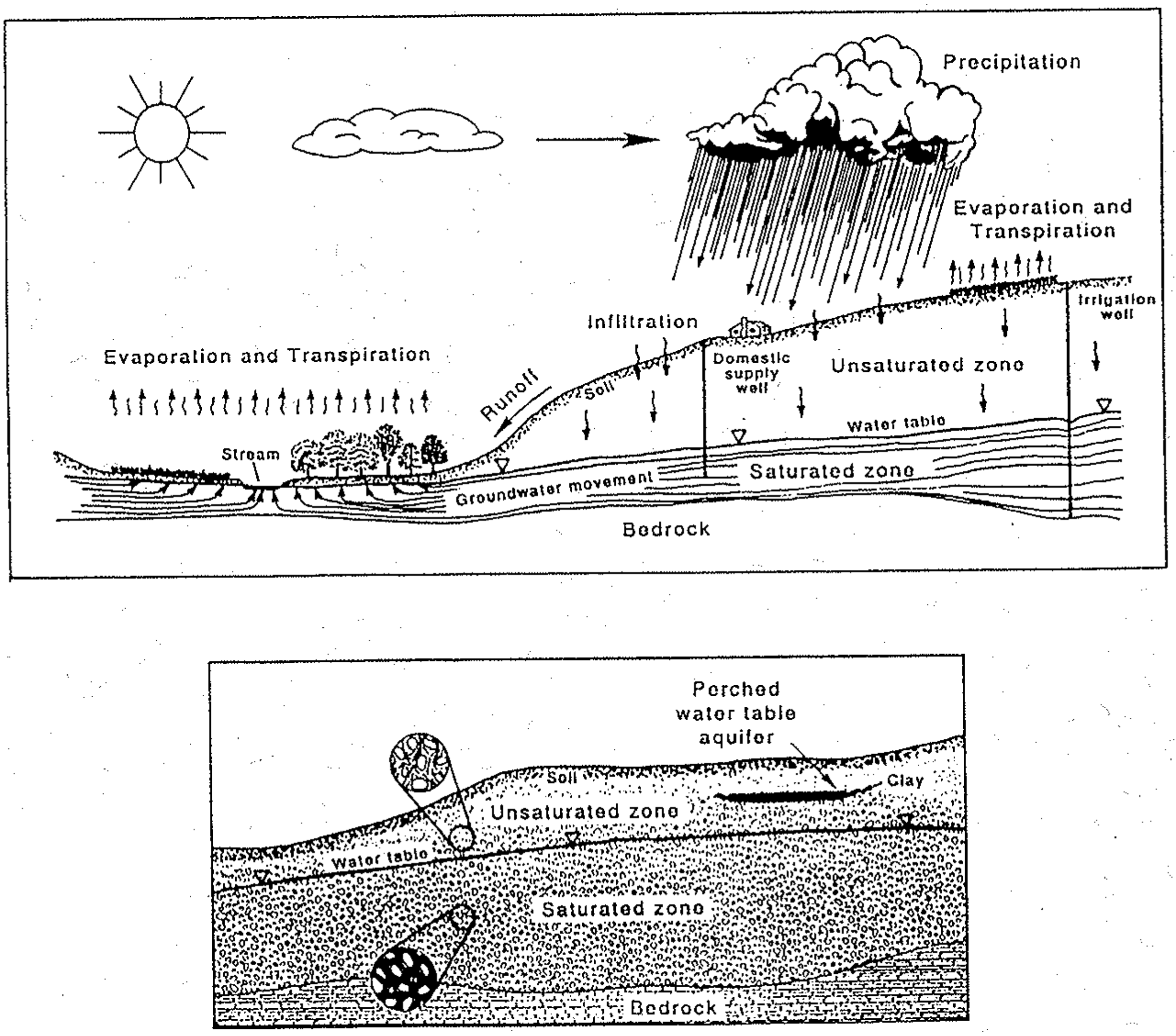

Fig. 2—*Groundwater cycle and idealized cross section*