and red sandstone and lenses of red shale and conglomerate. The Santa Rosa either crops out or is overlain by a thin mantle of sand over a large area in eastern Eddy County.

Overlying the Santa Rosa sandstone in the southeast part of the county are redbeds, possibly the Chinle formation, consisting of a thick series of red shales and thin interbedded sandstones. In Eddy County the Chinle is covered, in large part at least, by a thin mantle of dune sand.

Stock wells in the east and southeast parts of Eddy County probably obtain water from the sandstones of the Dockum group. The water is generally of better quality than that in the underlying Rustler formation, although some wells in the Dockum group produce impotable water.

TERTIARY SYSTEM

Ogallala formation

The Ogallala formation of late Tertiary age, caps the small area of the High Plains in the northeast corner of the county. The Ogallala is composed of clay, silt, sand, and gravel, locally cemented with calcium carbonate (caliche). The formation supplies water of good quality to a few stock wells in its outcrop area in the county. The Potash Co. of America gets a part of its water from the High Plains east of Eddy County, and this general area has been considered as a possible source of water for the city of Carlsbad.

QUATERNARY SYSTEM

The Quaternary deposits in Eddy County include large areas of alluvium and dune sand and some small isolated areas of lake and spring deposits. The alluvium can be divided into older and younger alluvium which are separated in most places by an angular unconformity.

Older alluvium

Quartzose conglomerate.—The quartzose conglomerate may be basal Ogallala as suggested by Bretz and Horberg (1949), rather than an early Pleistocene deposit as has been commonly believed. It is present in two large areas in Eddy County. In the Roswell basin it extends in a belt 10 to 20 miles wide, mostly west of the Pecos, from Seven Rivers north to and beyond the county line. The other area is also mainly west of the Pecos and extends south from Carlsbad to the Black River. The quartzose conglomerate ranges in thickness from a feather edge to more than 300 feet and consists of clay, silt, sand, gravel, and conglomerate. In both areas the conglomerate appears to be thickest a few miles west of the Pecos and to thin abruptly to the east and more gradually to the west. It is nearly everywhere slumped

water at Malaga Bend
formation (Robinson

unconformably over-
ıst of the Pecos River,
oup or its equivalents
edding of the Rustler
e of the Salado forma-
from about 200 feet in
st of Carlsbad. It con-
green sandy clay, and

s can be divided into
ıick and an upper an-
and others, 1942, pp.
ıale but includes some
nit contains irregular
ıt basal dolomite.
ıstler formation in the
inson and Lang, 1938,
arts: The upper part,

TLER FORMATION
V MEXICO

THICKNESS Ft.	DEPTH Ft.
.. 30	30
.. 30	60
. 100	160
. 30	190
. 20	210
. 35	245
. 30	275
. 70	345
. 20	365
.. 130	495
.. 5	500

concealed by the mantle of the so-called [illegible] both the Rustler and the overlying Triassic redbeds. The Rustler also crops out west of the Pecos in the Frontier Hills.

In its outcrop areas the Rustler yields water to many stock wells and some domestic wells. It also furnishes some of the water used by the International Minerals and Chemical Co., and the Potash Co. of America for refining potash. In the Carlsbad area it yields some water for small-scale irrigation. The water from the Rustler generally is not desirable for domestic use because of its high chloride and sulfate content. In certain areas wells penetrating the lower part of the Rustler yield a concentrated brine derived from the underlying Salado formation which cannot be used even for livestock. This brine aquifer at the base of the Rustler discharges salt water into the Pecos River in the vicinity of Malaga Bend (Robinson and Lang, 1938, pp. 77-100).

TRIASSIC SYSTEM

Dockum group

Overlying the Rustler formation in Eddy County are redbeds and sandstones of the Dockum group. The lower part of these beds has been considered Permian and correlated with the Dewey Lake redbeds by some geologists (DeFord, Willis, and Riggs, 1940). The total thickness of the Dockum group east of Artesia is about 1,000 feet. The formations of the Dockum group exposed in Eddy County are the Pierce Canyon redbeds, the Santa Rosa sandstone, and redbeds that possibly represent the Chinle formation.

The Pierce Canyon redbeds overlie the Rustler formation. They are about 350 feet thick and consist of red sandy shale and fine-grained sandstones marked with greenish-gray reduction spots. The formation thins to the north and is absent north of the latitude of Artesia. The Pierce Canyon redbeds crop out in the upper part of Nash Draw, in Clayton Basin, in some of the canyons on the east side of the Pecos River south of Malaga, and in other isolated areas east of the Pecos.

The Santa Rosa sandstone overlies the Pierce Canyon redbeds south of the latitude of Artesia and the Rustler formation north of Artesia. The Santa Rosa is 200 to 300 feet thick and consists of gray

AREA EAST OF THE PECOS RIVER

The area east of the Pecos River is a large area and includes approximately half of Eddy County. It is designated on plate 4 as 5a, 5b, 5c, and 5d.

PRINCIPAL AQUIFERS

The strata east of the Pecos River dip gently to the east and southeast. As a consequence the strata crop out in north-south bands as shown in plate 1. The Chalk Bluff formation crops out in a band 5 to 10 miles wide east of the Pecos River extending from Lake Avalon north to the county line and beyond. East of the Chalk Bluff formation and extending from the Texas State line to the Chaves County line is a band 2 to 10 miles wide in which the Rustler formation crops out, and east of the outcrop area of the Rustler is a band 12 to 20 miles wide, extending to the Lea County line, in which redbeds of the Dockum group of Triassic age crop out. In the extreme northeast corner of the county, the Ogallala formation crops out in an area of a few square miles coextensive with the High Plains physiographic area. A veneer of dune sands covers most of the area, and in a few places, especially in a narrow band along the east side of the Pecos extending from Malaga to north of Carlsbad, relatively thin deposits of Quaternary alluvium are present.

Only alluvium, near the river, and the cavernous limestone and gypsum of the Rustler formation produce large quantities of water. Much of the water in the area east of the Pecos River is highly mineralized. Moderately large quantities of rather highly mineralized water are used by the potash companies for some industrial purposes, but in most of the area the ground water is used only for stock and domestic purposes.

Chalk Bluff and Castile formations

East of the Pecos the limestone, redbeds, and gypsum of the Chalk Bluff formation crop out in a belt 5 to 10 miles wide from Lake Avalon north to beyond the county line. The ground water in the area immediately east of the river between Lake Avalon and Carlsbad has been discussed under the heading "Ground water in the Carlsbad area."

In the outcrop area of the Chalk Bluff formation east of Lake McMillan water of fair to good quality is available in most places at depths less than 200 feet. The water probably is in solution channels in limestone and gypsum, and the quantity and quality available range widely within short distances. Two wells on the Neatherlyn place in the SE¼NE¼ sec. 14, T. 19 S., R. 27 E., illustrate the complex groundwater conditions in this area. The wells are about 20 feet apart. The north well is reported to be about 152 feet deep and to yield moderate supplies of hard water. The measured depth to water in this well is

Dockum group

Sandstone beds in the Triassic Dockum group and possibly in the Permian Dewey Lake redbeds are the chief sources of ground water in a belt 10 to 20 miles wide along the east border of the county. The depth to water in this area is generally less than 300 feet, and the quantity of water available from wells is generally sufficient for stock or domestic use. None of the wells visited in this area was reported to be weak or inadequate.

Most of the wells in the outcrop area of the Dockum group yield water of better quality than the wells to the west that produce from the Rustler formation. Analyses were made of 21 samples of water from wells probably taking all or part of their water from the Triassic redbeds. The hardness as calcium carbonate in the 21 samples ranged from 201 to 3,590 parts per million and was more than 1,000 parts per million in 14 of the 21. The chloride content ranged from 17 to 785 parts per million and was more than 200 parts per million in 10 of the samples. Probably about half the wells in the Triassic redbeds produce water that is considered usable for domestic purposes. The water from well 20.30.20.130, which contains 388 parts per million of chloride and has a hardness as calcium carbonate of 1,980 parts per million, is used for domestic purposes but is of very poor quality for such use. None of the wells in the Triassic redbeds produces water too highly mineralized for stock.

Ogallala formation

In the small area of the High Plains in the northeast corner of the county, water of satisfactory quality is obtained from a few stock wells. One of these, 16.31.2.122, is reported to be 320 feet deep and the depth to water is reported to be about 300 feet. This well may obtain water from the sand and gravel of the Ogallala formation or possibly from the underlying Triassic redbeds. The water from this well contained only 47 parts per million of sulfate and 14 parts per million of chloride, and its hardness as calcium carbonate was 330 parts per million.

Because this area is close to the escarpment marking the edge of the High Plains, the thickness of water-saturated material is probably small. However, the wells in this area appear to be adequate for stock supplies.

Alluvium

East of the Pecos between Salt Lake (Laguna Grande de la Sal) and Malaga Bend is an area of several square miles of Quaternary alluvium. In April 1950 a test well, 23.28.13.131, was drilled by the U. S. Potash Co. in the alluvium in this area. The well penetrated 78 feet of clay, silt, sand, gravel, and conglomerate, and was bottomed in redbeds of the Rustler formation. The well was pumped for a few hours

TABLE 1. RECORDS OF WELLS IN EDDY COUNTY, NEW MEXICO. (Continued)

LOCATION NUMBER	OWNER OR NAME	DATE COMPLETED	TOPOGRAPHIC SITUATION	ALTITUDE ABOVE SEA LEVEL (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)	PRINCIPAL WATER-BEARING BED	
							CHARACTER OF MATERIAL	GEOLOGIC UNIT
17.28.2.240	Hal Bogle	–	Flat between mesas	–	–	6 (?)	Redbeds (?)	Dockum (?)
14.220	do.	–	Rolling	–	–	7	do.	do.
19.200	do.	–	do.	–	–	8	Redbeds, gypsum (?)	Chalk Bluff or Rustler
22.230	–	–	Flat between mesas	–	–	6	Redbeds (?)	Rustler or Dockum (?)
17.29.22.110	–	–	Bear Grass draw	3,550	–	6	do.	Dockum (?)
29.400	Bishop (?)	–	Flat	–	–	7	do.	do.
17.31.34.000	–	–	Rolling	–	–	6 (?)	Redbeds	Dockum
18.21.13.310	Andy Teel	1915	–	4,100	520	8	Limestone	San Andres
27.440	do.	1947	Broad valley	4,200	667	10	do.	do.
32.430	George Teel	1946	Rolling	4,300	815	6	do.	do.
18.23.6.140	Couhape Bros.	1941	S. of Rio Penasco	4,060	500	10	do.	do.
18.25.23.111	G. M. Phelps	–	Blackdom Terrace	–	–	–	Alluvium (?)	Quaternary (?)

See explanation at beginning of table.

LOCATION NUMBER	WATER LEVEL: BELOW LAND SURFACE (feet)	WATER LEVEL: DATE OF MEASUREMENT	YIELD (g.p.m.)	METHOD OF LIFT	USE OF WATER	REMARKS
17.28.2.240	27.6	Dec. 1, 1948	3	W	S	Depth to water measured while pumping.
14.220	80	–	61	W	S & D	Driller: Cy Hinshaw. See analysis, Table 3.
19.200	224.3	Dec. 2, 1948	1.2	W	S	Depth to water measured while pumping.
22.230	45.5	Dec. 1, 1948	–	N	N	Abandoned stock well.
17.29.22.110	79.7	Nov. 29, 1948	3 E.	W	S	Depth to water measured while pumping.
29.400	210	Dec. 3, 1948	1.1	W	S	do.
17.31.34.000	271+	Dec. 6, 1948	3.5	W	S	do. See analysis, Table 3.
18.21.13.310	505	–	10 R.	W	S & D	Formerly C.C.C. well. Cased to 30 ft.
27.440	530	–	–	W	S	Cased to 120 ft.
32.430	800 (?)	–	12 R.	W	S & D	Lowered cylinder 5 ft. in 1948 because water level declined. Cased to 580 ft.
18.23.6.140	440	Jan. 12, 1950	–	W	S & D	
18.25.23.111	117.8	Jan. 1950	–	W	S	

See explanation at beginning of table.
1 Measured Dec. 3, 1948.