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DEPARTMENT OF THE INTERIOR
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September 30, 1958

AEC-125/9

Mr. James E. Reeves
Assistant Manager for Test Operations
Albuquerque Operations Office
U. S. Atomic Energy Commission
P. O. Box 5400
Albuquerque, New Mexico

Dear Mr. Reeves:

Transmitted herewith are ten copies of TEM-1045, "Preliminary appraisal of ground-water conditions in southeastern Eddy County and southwestern Lea County, New Mexico," by W. E. Hale and Alfred Clebsch, Jr., September 1958.

On September 2, 1958, fifty copies of a preliminary draft of this report were transmitted to you, in accordance with your request of August 13 to the Director, Geological Survey.

Sincerely yours,

Andrew Bronson
for W. H. Bradley
Chief Geologist

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRELIMINARY APPRAISAL OF GROUND-WATER CONDITIONS IN SOUTHEASTERN EDDY COUNTY AND SOUTHWESTERN LEA COUNTY, NEW MEXICO*

By

W. E. Hale and Alfred Clebsch, Jr.

September 1958

Trace Elements Memorandum Report 1045

*This report concerns work done on behalf of Albuquerque Operations Office, U. S. Atomic Energy Commission.

USGS - TEM-1045

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PRELIMINARY APPRAISAL OF GROUND-WATER CONDITIONS IN SOUTHEASTERN EDDY COUNTY AND SOUTHWESTERN LEA COUNTY, NEW MEXICO

By

W. E. Hale and Alfred Clebsch, Jr.

Introduction

This report is a preliminary appraisal of the ground-water conditions in an area southeast of Carlsbad, New Mexico prepared by the U. S. Geological Survey at the request of the Albuquerque Operations Office of the Atomic Energy Commission. The Commission desires complete data on all wells and information on the direction and rate of movement of ground water in the water-bearing beds within a radius of approximately 15 miles of a proposed test site in sec. 34, T. 23 S., R. 30 E. in southeastern Eddy County. The request was made on August 13, 1958, and September 3, 1958, was scheduled as the date for submitting the report.

Because of the short time available, most of the data were assembled from publications and readily available data in the files of the Geological Survey. Two days were spent in the field in the project area to gain a general picture of geologic and other conditions and to obtain data on a few wells that are necessary for interpretation of ground-water movement.

The area involved is in southeastern Eddy County and southwestern Lea County and extends south from T. 21 S. to the New Mexico-Texas State line and east from R. 28 E. to R. 33 E., a total area of about 1,200 square miles (figs. 2 and 3).

Drainage and Topography

The Pecos River, the major stream in southeastern New Mexico, flows through the southwestern part of the area. Several reservoirs and diversion dams along the stream control the flow of the river, but owing to the discharge of ground water from the alluvial basin south of Carlsbad, the river has a perennial flow through the area. The area west of the river is drained by tributaries of the Pecos River but most of the tributaries are commonly dry. Black River and Delaware River are tributary streams which usually have flow near their mouths. The area east of the Pecos is, in general, poorly drained. Here the several normally dry tributaries head within a few miles of the river. Farther east short drainage courses commonly terminate in the many closed depressions which abound in the area. In still other parts of the upland area sand dunes prevent runoff, mostly by absorption of rainfall.

Waters of the Pecos River are used to irrigate lands west of the river between Carlsbad and Malaga and narrow tracts of land along the east side of the river south of Loving in New Mexico. Water is stored in Red Bluff reservoir just below the State line for irrigation in Texas. The minimum flow of the Pecos River near the State line has approached 10 cubic feet per second (cfs) during the late summer for a number of years, and in some years it has been below 10 cfs.

The plain west of the Pecos River between Carlsbad and Malaga slopes gently toward the river. South of Malaga the land surface is undulating and although the area is well drained in general, there are numerous closed depressions. Some of the land in the depressions is farmed but most of the area south of Malaga is utilized for grazing.

East of the bottomlands of the Pecos River along a belt 5 to 10 miles wide paralleling the river, the land surface is characterized by numerous depressions and north-trending scarps that border uplands having a relief of a few hundred feet. One of the principal features in this belt is Nash Draw, a depression about 5 miles wide that extends northeast about 20 miles from the Pecos River in the vicinity of Loving. Within the general depression of Nash Draw several smaller depressions are preserved, the largest of which is Laguna Grande de la Sal. Surface water flows into these smaller depressions and there is no through surface drainage to the Pecos River. Although Nash Draw terminates on the south near Loving, the general depression extends as an unnamed feature south to the vicinity of Malaga.

The uplands east of Nash Draw rise 200 to 600 feet above the Pecos River. Sand dunes and numerous small undrained depressions are common on this surface. Farther south the upland surface is somewhat less sandy and in places caliche is exposed. Here, too, depressions abound, some more than a mile in diameter. Along the State line, southwest-trending gullies and arroyos have cut into this upland area.

Geologic Setting

The area under consideration is in the northwestern part of the Delaware Basin subsurface geologic province. Rock units include evaporites, sandstone, limestone, dolomite, and red beds of the Ochoa series of late Permian age, red beds and sandstone of Late Triassic age, and alluvial, lake, and wind deposits of Tertiary and Quaternary age. The stratigraphic units are shown on table 1.

The Salado formation ranges from about 0 to 2,100 feet thick and is principally halite, but also contains anhydrite, polyhalite, and other potassium salts, as well as a few sandy and clayey beds. There is virtually no circulating ground water in the Salado, so its present upper limit is the practical lower limit of ground-water occurrence of interest in this study. The residual material that remains from solution of the Salado and overlying Rustler formations is considered here, for convenience, to be part of the Rustler.

The Rustler formation ranges from about 90 to more than 500 feet thick and consists predominantly of anhydrite, gypsum, gray sand, red beds, and dolomitic limestone (Robinson and Lang, 1938). In the subsurface it also contains halite. An upper dolomitic limestone unit was referred to as the Magenta member and a lower dolomitic limestone unit the Culebra member by Adams (1944, p. 1614). In its outcrop area the formation has been profoundly altered by solution and collapse, both in the Rustler itself and in the underlying Salado. Thus, the bedding presents slumped and draped appearances, and the carbonate rocks are highly brecciated. Structural attitudes in

System	Series	Formation	Thickness (feet)
QUATERNARY		Quaternary alluvium, playa sediments, and dune sand	0-1,100 ±
TERTIARY		Ogallala formation	0-200 ±
TRIASSIC	Upper Triassic	Chinle formation, Santa Rosa sandstone, Tecovas formation, and Pierce Canyon red beds	0-1,500 ±
PERMIAN	Ochoa	Dewey Lake red beds	
		Rustler formation	90-500
		Salado formation	0-2,100 ±

Table 1.--Generalized stratigraphic section in southeastern Eddy County and southwestern Lea County, N. Mex. Compiled from Hendrickson and Jones (1952), Jones (1954), Maley and Huffington (1953), Nicholson (in preparation), and Robinson and Lang (1938).

general are controlled more by the effect of solutional removal of evaporites than by deep-seated tectonic forces. Distinctive lithologies in the Rustler make it a good unit for delineating structures using subsurface data.

The Dewey Lake red beds are the uppermost beds of Permian age in the area. The unit may be correlative with the Pierce Canyon red beds and the Tecovas formation as used in the west Texas-southeastern New Mexico area. The Dewey Lake overlies the Rustler formation conformably, but in many places it has been removed by post-Permian erosion. The unit consists of red, blue, and green shale, and red siltstone and sandstone. Because of the difficulty in distinguishing it from the overlying Triassic rocks, and because of similarities in hydrologic characteristics to the Triassic rocks, the Dewey Lake has been considered with the Triassic on figure 2 and in Table 1.

Triassic rocks in the area consist of red shale, siltstone, and sandstone--typical continental red-beds lithology. Several units have been mapped on the surface and in the adjacent part of Lea County; namely, the Pierce Canyon red beds, the Santa Rosa sandstone, and the Chinle formation. The Tecovas formation has been described from well cuttings. These rocks are referred to as the Dockum group in the table of well records in this report because this term was used in some of the sources of data. Upper Triassic rocks in the area overlie the Dewey Lake red beds unconformably. The area was apparently uplifted during Early and Middle Triassic time, when some of the Ochoan rocks were removed by erosion and some were removed by subsurface solutional

processes. Subsidence and collapse consequent to solution also took place during deposition of the Upper Triassic rocks, resulting in over-thickening in some places and in apparent unconformities within the stratigraphic units.

Jurassic and Cretaceous rocks are not known in the area of this report.

Tertiary and Quaternary sediments lie unconformably on a post-Triassic erosion surface. They range in grain size from clay to coarse boulder gravel. They are capped in many places by a layer of caliche. In the eastern part of the area the unconsolidated material may be correlative with the Ogallala formation of Pliocene age, as found in the southern High Plains. This unit consists of semiconsolidated fine-grained calcareous sands, but it also contains silt, clay, and gravel. The gravel commonly occupies channels in the pre-Ogallala surface. In the southern part of the area the unconsolidated material is reported to be as much as 1,100 feet thick (Maley and Huffington, 1953). On the basis of logs of two wells in the northwestern part of T. 26 S., R. 30 E., the fill consists mainly of red, blue, and brown clay and silt, and fine-grained sand. In the eastern part of the area, lake beds are reported by Nicholson (in preparation) and these deposits may be found to the west in the subsurface.

Dune sands cover large areas in the immediate vicinity of the site and elsewhere (the Mescalero sands of Darton), but only in very limited areas are they probably more than a few tens of feet thick.

Quaternary alluvium in the vicinity of the Pecos River ranges from clay in the playas to well-indurated limestone conglomerate. Thickness of the material is controlled to a great extent by the uneven surface beneath the alluvium and thicknesses of as much as 300 feet are not unusual.

Ground Water

No water is known to be moving through the Salado formation in this area. Above the top of the salt of the Salado extensive aquifers exist in the Salado-Rustler residuum, the dolomites of the Rustler formation, the sandstones of Triassic age, and the Tertiary and Quaternary deposits.

An aquifer in the Salado-Rustler residuum immediately above the top of the salt in the vicinity of Nash Draw has been described by Robinson and Lang (1938); its general boundary as defined by them is shown on figure 2. The aquifer contains a brine which is moving down Nash Draw and on south to the vicinity of the Pecos River near Malaga, where the brine discharges through the fill and into the river at the rate of about 200 gallons a minute as estimated by Theis (1942). The gradient of the piezometric surface of the brine is about 1.4 feet per mile and the aquifer has a transmissibility of approximately 60,000 gallons a day per foot as estimated by Hale, et al (1954). Assuming that the aquifer is about 50 feet thick and that the effective porosity is about 0.2, the rate of movement of brine is about 0.2 foot per day.

This basal brine aquifer probably extends eastward in places beyond the general boundary as shown in figure 2. However, the solution of salt in the Rustler and Salado formations has been retarded by the red-bed cover to the east. There are no data available to indicate an extensive system of brine-bearing beds in the area to the east of Nash Draw. Farther south where intensive solution of the salt in the Salado and Rustler formations has taken

place there is likely to be a brine moving through the Salado-Rustler residuum but no information is presently available on this section in the southern part of the area. The brine, if present, may move at depth into the lower part of the thick fill in the southeastern part of Eddy County and thence southward.

The Culebra dolomitic limestone member is the most persistent aquifer within the Rustler formation in this area. The Magenta dolomitic limestone member, the gypsum, and siltstone beds in the Rustler contain water locally, but no widespread aquifers are known in these beds; rather the siltstones and clays in the section retard movement of water in the Rustler.

The Culebra member yields large supplies of highly mineralized water to wells in places in upper Nash Draw (Hendrickson and Jones, 1952, p. 73). Elsewhere in the outcrop area of the Rustler a sufficient supply of water usually can be developed from the dolomitic limestone for stock use. Locally the water may be of fair quality where the Culebra is near the surface and receives recharge nearby but commonly the water is highly mineralized and only of necessity is it used for stock purposes.

To the east of Nash Draw, where the Rustler is overlain by clays of the Dewey Lake formation and beds of Triassic age, it may be expected to contain very little water, but data are not presently available on ground water within the Rustler east of

Nash Draw. In the southern part of the area, where much of the salt has been removed from the Salado and Rustler formations, there is likely to be considerable water in the Rustler, although again there are no data available on this formation in this area at present.

Water in the Culebra member moves southward down Nash Draw. In the outcrop area of the Rustler to the east of Nash Draw water in the formation probably moves toward Nash Draw. To the north and south of Nash Draw water in the formation seemingly moves south and southwest to the Pecos River (fig. 3). Near the Pecos River, where blocks of Culebra dolomitic limestone are slumped in various directions, water probably moves from the limestone through the fill material between the blocks of limestone.

Water in the Rustler formation on the west side of the river is closely related to the water in the alluvium. Water appears to be moving through the Rustler formation and the alluvium in an eastward direction to the Pecos River.

No information is available on the rate of movement of water in the Rustler formation but it is likely the rate of movement is not great, perhaps not more than 1 to 2 feet a day.

Data on which to interpret ground-water movement in the Triassic formations are very incomplete (see fig. 3). The area extending southeastward from T. 22 S., R. 31 E. to T. 25 S., R. 33 E. is apparently a ground-water divide; water in at least the upper part of the Triassic section appears to be under water-table conditions. Water moving eastward in the sandstone layers is

under artesian pressure a few miles east of the map area. Water moving southwestward from the ground-water divide apparently is confined only locally. Water in the Triassic rocks discharges in the subsurface to the deep alluvial basin centered near the State line in or just south of T. 26 S., R. 31 E.

Although some water may occur in the intergranular spaces of sandstone and conglomerate in the Triassic, if the occurrence is similar to conditions in the Triassic farther north in the Pecos Valley, most of the water moves through joints and along bedding planes. Velocities may be on the order of 0.3 foot per day; however, no quantitative data are presently available to support this statement. Water in the Triassic is chemically suitable for stock and some domestic uses; it is moderately high in sulfate.

There is no continuous zone of saturation in the Tertiary and Quaternary alluvial fill of the eastern part of the area. Data from the few wells indicate that the water is perched or semiperched, and that the occurrence is spotty and depends to a great extent on favorable local conditions. The water probably discharges downward through or off the perching beds into deeper zones of the alluvial blanket, or into the sandstones of Triassic age.

In the thick alluvial fill of the southern part of the area, water apparently moves out of the Triassic and Permian aquifers and into the alluvium. Water continues to move southwestward toward the Red Bluff reservoir. Inasmuch as these thick accumulations of sediment have been derived to a great extent from evaporites and

fine-grained clastic rocks, in general, their permeability is probably low, resulting in fairly low velocities. However, where the fill has been cemented and subsequently ruptured by collapse or subsidence, moderately high permeabilities might be expected.

Water in the Tertiary and Quaternary deposits shows a wide range in chemical quality. Perched water in the eastern part of the area is only slightly mineralized. Chemical quality in the deeper alluvial basins is similar to water from the Triassic or Permian aquifer that discharges into the alluvium.

The alluvium west of the river between Carlsbad and Malaga yields large supplies of water to wells in most places. The source of most of the water in this part of the alluvial basin is from the water derived from the Pecos River through leakage from canals and return of water used for irrigation in the Carlsbad Irrigation District. The water has a high sulfate content but is suitable for irrigation use. The general direction of the movement of water in this alluvial basin north of Black River is to the east toward the Pecos River and toward Black River in the immediate vicinity of Black River (fig. 3).

No information is available on the rate of movement of water in the alluvial basin west of the river. In general the rate of movement expected would be less than 1 foot per day. However, where the water is moving through solution channels in the conglomerate beds in the alluvium, the rate of movement might be more than 100 times greater than that through the unconsolidated part of the alluvium.

The alluvium south of Malaga is spotty and has a considerable range in thickness. Water in the alluvium is probably continuous with the water in the Rustler formation. Movement of the water in this area was mentioned in the discussion of the water in the Rustler formation.

Conclusions

Brine is moving southward in the Nash Draw area in an aquifer in the Salado-Rustler residuum immediately above the salt beds of the Salado formation. The aquifer appears to be confined to the Nash Draw-Malaga area but it may extend farther east in places. The discharge from the aquifer is about 200 gallons a minute and the rate of movement of the brine is estimated to be about 0.2 foot per day. No extensive aquifer is known to exist immediately above the salt in the eastern part of the area but the Salado-Rustler residuum may contain brine in the southern part of the area.

Water occurs locally in gypsum, siltstone, and dolomitic limestone of the Rustler formation in the belt of outcrop on the east side of the Pecos River and in the area west of the river south of Malaga. The most persistent aquifer is the Culebra dolomitic limestone member from which large yields of highly mineralized water have been obtained in the upper part of Nash Draw. Elsewhere, supplies sufficient for stock use generally can be developed from the dolomitic limestone and the water may be of fair quality where the limestone receives recharge locally. Water in the Rustler formation in the outcrop area is moving toward the Pecos River probably at rates of no more than 1 to 2 feet a day. The Rustler formation probably contains little water in the eastern part of the area where it is overlain by shales and clays of the Dewey Lake red beds and clays of Triassic age.

No water-bearing beds are known to occur in the Dewey Lake red beds. The unit probably retards downward movement of water from the sandstones of Triassic age.

Sandstones of Triassic age yield water of fair quality for stock and some domestic uses in the eastern part of the area. The inferred direction of movement of water in these sandstones is to the south with components of movement to the west in the western part of the outcrop area and to the east in the eastern part of the area. The rate of movement in the sandstones may be on the order of 0.3 foot per day.

The water in the alluvium west of the Pecos River is moving eastward to the river. This water contains high concentrations of sulfate. The rate of movement of water through the unconsolidated deposits may be on the order of 1 foot a day but in the channels developed in the limestone conglomerate the rate of movement may be more than 100 times the rate in the unconsolidated deposits.

In the uplands in the eastern part of the area, the sandstones, sand, and gravel of Tertiary and Quaternary age yield water of relatively good quality to stock and domestic wells. The movement of water in these aquifers probably is in the same general direction as that in the sandstone of Triassic age and in places these aquifers form a common aquifer.

Water in thick fill in the southeastern part of Eddy County is of fair quality at shallow depth but the fill at greater depth probably contains brine. The water apparently is moving southward into Texas.

Considerable effort in the field would be required to complete the inventory of wells in the area. Other items for consideration include examination and correlation of potash, oil, and geophysical test hole logs applicable to the area, drilling of one to four test holes for geologic and hydrologic data, and the collection of water samples for radiochemical analyses.

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Records of Wells

Explanation

All wells drilled unless otherwise noted in "Remarks".

In all columns: M, measured; R, reported; Est., estimated.

Well Numbers: See diagram (fig.1) for method of locating wells. Letters following number indicate successive wells in the same location.

Owner or tenant: Name enclosed in quotation marks is name of well.

Altitude: Altitude is given to the nearest foot. In the area of topographic map coverage (Carlsbad, Malaga, and Nash Draw quadrangles) altitudes have been interpolated from the maps. In the vicinity of Laguna Grande de la Sal and Malaga Bend altitudes of many wells have been determined by spirit level. In the southern and eastern part of the area altitudes have been determined by aneroid altimeter or interpolated from AMS Sheet NI-13-12, Hobbs, Series N502.

Character of material: S, sand; G, gravel; gyp, gypsum; ls, limestone; Slt, silt; Ss, sandstone.

Type of pump, power, and use:

Pump designations: T, turbine; L, cylinder; J, jet.

Power designations: W, windmill; E, electric; Ic, internal combustion.

Use designations: D, domestic; S, stock; I, irrigation; In, industrial; O, observation; N (in any column), none.

Remarks: WBF, water bearing formation.

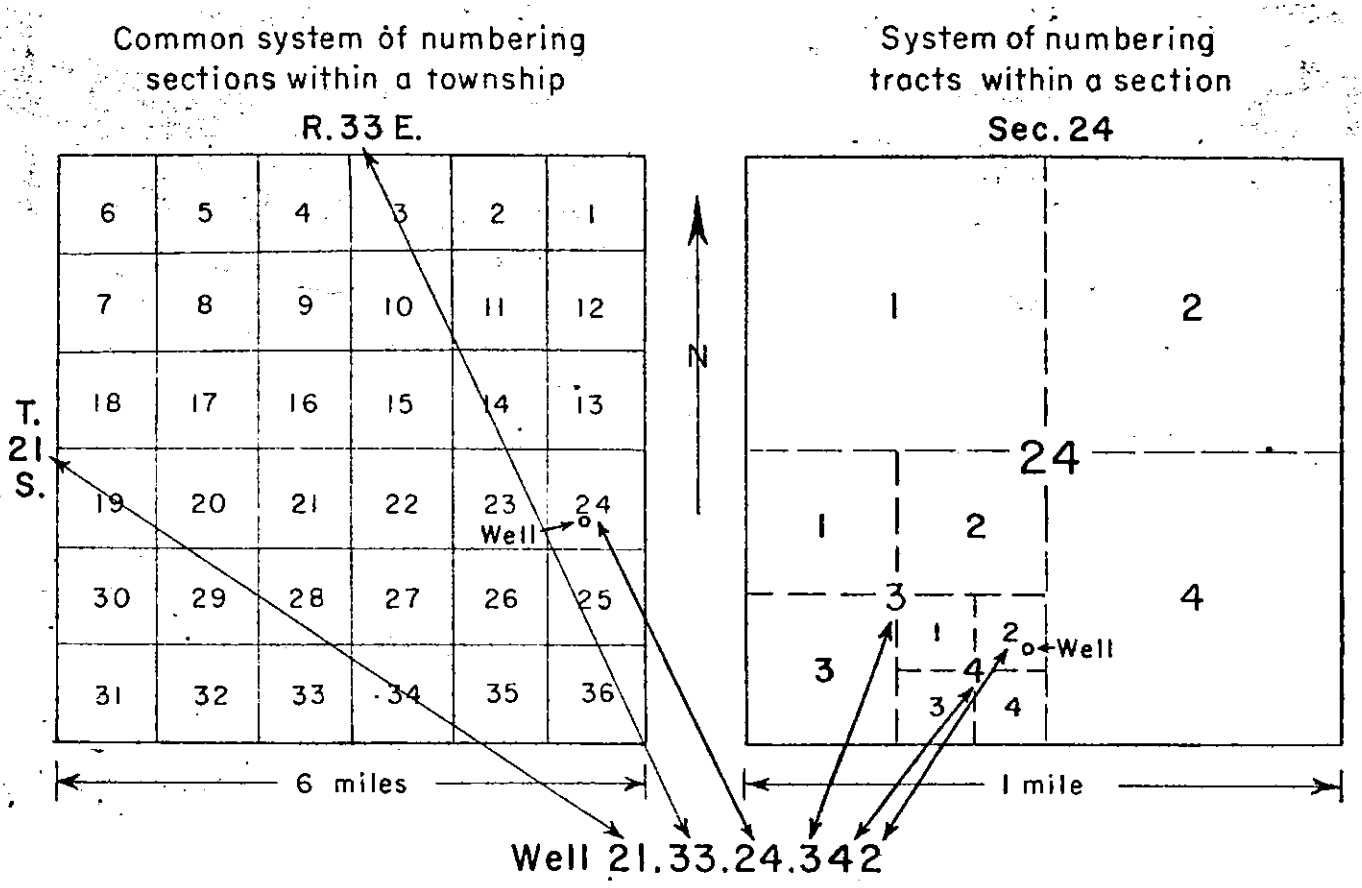

Figure 1.--System of numbering wells in New Mexico

Records of wells in southeastern Eddy County and southwestern Lea County, N. Mex.

Location number	Owner or tenant	Year completed	Altitude above sea level (ft)	Depth of well (ft)	Diameter of casing (in.)	Principal water-bearing bed		Water level		Type of pump, power, and use	Remarks
						Character of material	Stratigraphic unit	Depth below surface (ft)	Date of measurement		
21.28.18.130	Bybee	-	3,150	-	7	-	Alluvium(?)	18.9	1/21/50	L,W,S	-
21.29.18.130	"Lusk east well"	-	3,290	160	6	Red beds(?)	Rustler(?)	135.1	12/30/48	L,W,S	-
21.33.18.112	D. C. Berry	-	3,900	-	-	-	Ogallala(?)	143.0	6/21/54	L,W,S	-
21.33.28.124	San Simon Ranch	-	3,690	224	7½	-	Dockum	179.5	6/30/54	N,N,N	"Standard well"
22.28.4.130	"Andrews well"	-	3,142	-	6	Red beds, gyp	Rustler(?)	130.6	12/17/48	L,W,S,	Depth to water measured while pumping.
22.28.30.443	Calvani Brothers	-	3,045	136	18	S and G	Alluvium	15.1	1/14/55	N,N,O	-
22.29.11.000	International M. and C. Corp.	-	3,230	400	-	Gyp	Rustler	278 R	5/21/49	N,N	Test hole for No. 3 shaft; water just above salt - no water found in limestone.
22.29.12.224	do.	-	3,140	-	12	Red beds, gyp, ls	do.	119.1	5/18/49	N,N	-
22.29.33.230	J. Dublin	-	3,016	66	5	-	-	56.2	5/11/38	S	-
22.29.33.240	-	-	3,020	65	6	-	Alluvium(?)	56.2	12/17/38	L,W,S	-
22.30.5.431	International M. and C. Corp.	-	3,120	-	-	Red beds, gyp, ls	Rustler	87.5	5/18/49	T,In	Yield 260 gpm R.
22.30.5.443	do.	-	3,100	-	-	do.	do.	68.0	5/18/49	T,In	-
22.30.6.344	do.	-	3,145	-	-	do.	do.	110.3	5/20/49	T,In	Depth to water measured while pumping. Yield 700 gpm R.
22.30.6.424	do.	-	3,150	-	-	do.	do.	112.4	5/18/49	N,N	-
22.30.6.444	do.	-	3,155	-	20	do.	do.	117.3	5/18/49	N,N	Unused.
22.30.7.244	do.	-	3,120	-	12	do.	do.	85.7	5/18/49	N,N	-
22.30.7.311	do.	-	3,134	250	12	do.	do.	106.0	5/18/49	N,N	-
22.30.8.241	do.	-	3,155	-	24	do.	do.	115.1	5/18/49	N,N	-
22.30.10.310	C. Johnson	-	3,130	77	6	Red beds, gyp, ls., or S and G	Rustler or alluvium	56.0	12/23/48	L,W, D,S	-
22.30.17.310	-	1938	3,079	370.5	6 5/8	-	Rustler	149.7	7/11/38	N,N,O	Plugged back to 342 ft. U.S.G.S. No. 5 test well.
22.30.17.310a	-	1938	3,079	90	2	-	-	75.5	7/11/38	-	WBF: 80-85 ft. Casing set in same hole as .310.

Records of wells in southeastern Eddy County and southwestern Lea County, N. Mex.

Location number	Owner or tenant	Year completed	Altitude above sea level (ft)	Depth of well (ft)	Diameter of casing (in.)	Principal water-bearing bed		Water level		Type of pump, power, and use	Remarks
						Character of material	Stratigraphic unit	Depth below surface (ft)	Date of measurement		
22.30.30.240	"J Bar F well"	-	3,000	-	8	Red beds, gyp, ls	Rustler or alluvium	134.0	12/17/48	L,W,S	-
22.33.13.200	San Simon Ranch	-	3,510	508	-	-	Triassic	-	-	L,W,S	WBF: 420 and 470
23.28.7.113	D. Brantley	1945	3,052	165	18	S, G	Alluvium	36.3	1/17/55	T,E, I,O	Yield 2,200 gpm. Drawdown 20 ft.
23.28.8.421	E. D. Rosson	-	3,023	89	12	do.	do.	36.2	1/18/55	T,E, I,O	-
23.28.11.114	B. Yarbro	-	2,993	100	16	do.	do.	15.3	1/18/55	T,E, I,O	-
23.28.12.330	U. S. Potash Co.	-	2,992	51	-	-	-	32.0	7/18/38	N,N,O	No casing. Dug to 36 ft. Augered (2") to 51 ft.
23.28.13.131	do.	1950	2,980	79	18	-	Alluvium	14.8	6/ 1/50	T, In	Red beds at 78 ft; cased to 32 ft. Yield 1,200 gpm R.
23.28.13.142	do.	1950	2,976	45	8	-	do.	9.8	5/ 1/50	N, O	Cased to 43 ft.
23.28.14.241	D. S. Harroun	1954	2,975	80	14	S, G	do.	27.8	9/ 7/54	T, Ic, I	Driller: Bond. Yield 2,500 gpm R.
23.28.15.411	J. Yarbro	-	2,998	88	16	do.	do.	18.6	1/18/55	N,N, N,O	
23.28.18.222	Carter Farms Co.	-	3,038	-	-	do.	do.	34.0	1/18/55	T,E, I,O	Temp. 68° F. Drawdown 25 ft. in 8+ hrs. Yield 2,475 gpm.
23.28.18.333	L. T. Lewis	1946	3,088	197	15	do.	do.	74.6	1/17/55	T,E, I,O	Driller: Bond. Yield 492 gpm M 9/ 7/54. Drawdown 13 ft. in 8+ hrs.
23.28.20.144	Carter Farms Co.	-	3,060	250	-	do.	do.	62.3	1/17/55	T,E, I,O	Yield 1,115 gpm M 9/ 7/54. Drawdown 18 ft. in 8+ hrs.
23.28.22.333	J. L. Seal	-	3,030	150	16	do.	do.	47.3	1/18/54	T,Ic, I,O	
23.28.23.133	A. R. Donaldson	1947	3,020	148	16	do.	do.	56.7	1/18/55	T,Ic, I,O	Driller: Kimmell and McDaniels.
23.28.25.311	J. Geovingo	1954	2,997	65	12	do.	do.	13.8	11/ 2/54	N,N,N	Dug well unused because of low yield, 200 gpm R, drawdown 35 ft.
23.28.28.441	W. D. Roberts	-	3,055	-	-	Gyp, S, and Slt	do.	12.4	10/27/54	L,W,S	Dug well.
23.28.29.243	J. R. Ogden	-	3,080	-	15	G, S, Slt	do.	72.7	11/ 2/54	T,E,I	
23.28.31.231	E. Gibbons	-	3,124	93	-	Gyp, S, Slt	Alluvium, Rustler	60.7	2/16/54	L,W, S,O	
23.28.33.141	J. B. Moore	1953	3,095	225	6	do.	Alluvium(?)	19.5	10/ 5/54	L,W,D	
23.28.33.443	Foundation Investment Co.	-	3,065	-	-	do.	do.	29.0	10/27/54	L,W,S	

Records of wells in southeastern Eddy County and southwestern Lea County, N. Mex.

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23.29.3.130	U. S. Potash Co.	-	2,958	10.2	2	-	-	1.3	7/5/38	N, N, O	1.2 ft. of surface casing.
23.29.4.320	do.	-	2,956	15	2	-	-	3.2	7/5/38	N, N, O	1.5 ft. of surface casing.
23.29.14.330	-	1937	3,002	240	-	-	Base of Rustler	69.1	4/30/37	N, N, O	Driller: H. and W. Drilling Co. Fogarty No. 1 oil test.
23.29.17.210	-	1938	2,956	286	6 5/8	-	do.	43.8	7/12/38	N, N, O	Plugged back to 265. U. S. G. S. No. 4 test well
23.29.17.210a	-	1938	2,956	17.5	5 3/16	-	-	10.5	7/12/38	N, N, O	Test well in same hole as .210 above. WBF: 11-51 ft.
23.29.17.320	U. S. Potash Co.	1937	2,949	9.3	48	-	-	2.4	7/12/38	N, N, O	Cased to 5 ft., Dug to 7 ft., augered to 9.3 ft.
23.29.18.430	Valley Land Co.	1927	2,954	12	2	-	-	6.1	7/5/38	N, N, O	Deepened from 10 to 12 ft in 1937.
23.29.19.120	-	1927	2,955	12.5	-	-	-	3.3	7/12/38	N, N, O	2 ft. of casing. U. S. G. S. observation well.
23.29.20.230a	U. S. Potash Co.	1938	2,947	5.6	2	-	-	1.4	6/21/38	N, N, O	Adjacent land flooded by irrigation water. Cased to 2.2 ft.
23.29.21.220	-	1937	2,945	10.6	2	-	-	0.3	7/11/38	N, N, O	Cased to 2 ft. U. S. G. S. obs. well.
23.29.22.120	U. S. Potash Co.	1937	2,968	220	6 5/8	-	-	22.6	7/11/38	N, N, O	Plugged to 31.3 ft. deep. No. 1 Test cased to 21.5 ft.
23.29.28.210e	do.	1937	2,967	341	3½	-	Base of Rustler	54.2	7/11/38	N, N, O	Plugged to 316; cased to 269.5. No. 2 test.
23.29.28.210f	do.	1937	2,967	46.3	3½	-	-	23.4	7/11/38	N, N, O	Same drill hole as .210e above. No. 2 test, cased to 27 ft. WBF: 31-71 ± ft.
23.29.28.430	Beeman, et al	1937	2,977	71	4	-	-	35.3	7/11/38	N, N, O	Cased to 51 ft; caved to 56 ft.
23.29.29.320	U. S. Potash Co.	1938	2,970	22.5	2	-	-	21.4	6/16/38	N, N, O	Uncased.
23.29.30.331	T. Givingo	1954	2,970	-	-	S, G	Alluvium	35.6	11/8/54	T, N, I	-
23.29.32.320	Valley Land Co.	1927	2,954	21.5	2	-	-	7.5	7/5/38	N, N, O	Cased to 8.5 ft.; cleaned to 12.5 ft. June 10, 1937
23.29.32.420	Beeman, et al	1937	2,974	57	6	-	-	31.2	7/11/38	N, N, O	Cased to 40 ft.
23.30.2.444	James brothers	-	3,250	300	7	Red beds	Dockum or Rustler	250.0	12/22/48	L, W, Ic, S	8/19/58: Heavy incrustation on tank and discharge pipe. Tape gets muddy
23.30.6.110	do.	-	3,000	200	12	do.	Rustler	110.0	12/22/48	L, W, S	-

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						Character of material	Stratigraphic unit	Depth below surface (ft)	Date of measurement		
23.30.6.424	"Nash well"	-	2,980	30±M	6	-	Alluvium	6.4	8/19/58	L,W,S	-
23.30.21.122	"Indian well"	-	3,165	-	12	Red beds	Rustler	-	-	L,W,Ic,S	Yield 3 gpm.
23.31.7.220	James Headquarters	1900 (?)	3,310	180	12	do.	Dockum	140 R	-	L,W,S,	Two wells here. Estimated yield 10 gpm.
23.31.29.113	do.	-	3,325	-	-	-	-	-	-	L,W,Ic,S	Cannot enter.
23.33.12.322	San Simon Ranch	-	3,685	400	-	-	Triassic	-	-	L,W,S	WBF: 370-400 ft.
23.33.28.334	Brinninstool	-	3,675	575	-	-	do.	500 R	-	L,W,S,D	Yield: 2.5 gpm, estimated.
24.28.7.231	L. T. Lewis	1946	3,065	160	13	S,G	Alluvium	14.2	1/18/54	N,N,N	Driller: Bond. Well destroyed in 1954.
24.28.11.442	A. Duarte	1954	2,975	200	16	do.	Alluvium	53.0	9/27/54	T,E,I	Driller: Brinninstool. Water becomes salty after about 12 hours pumping. Drawdown 50 ft. Temp. 67° F. Yield: 704 gpm M, 9/27/54
24.28.15.212	Frank Kendel	-	3,003	20	50	do.	do.	10.4	7/13/55	L,E,In	Water reported salty - filling station supply. Dug well.
24.28.16.331	C. P. Pardue	1955	3,048	161	14	do.	Alluvium (?)	40.0	7/13/55	T,Ic,I	Driller: Hemler. Yield: 1200 gpm R. Drawdown: 80 ft. R.
24.28.20.222	do.	-	3,050	-	-	do.	do.(?)	40.5	7/13/55	T,Ic, I	-
24.28.21.434	do.	-	3,005	62	8	do.	do. (?)	49.6	7/13/55	L,W,S	-
24.28.25.123	L. W. Pulley	-	2,945	-	-	do.	do. (?)	5.3	1/19/55	Ic, I,O	Dug well with centrifugal pump.
24.29.3.140	Weiner and McDowell	1937	3,075	388	8	-	-	136.1	2/2/38	N,N,N,O	Drilled to supply drilling water; Insufficient yield. Casing pulled and well abandoned May 1937.
24.29.4.340	Beeman, et al	1937	3,005	87	10	-	-	70.6	7/5/38	N,N,O	Uncased, caved to 79 ft.
24.29.5.110	Valley Land Co.	1927	2,951	9	2	-	-	3.2	7/5/38	N,N,O	Cleaned and deepened to 12 ft. in 1937.
24.29.8.110	-	1938	2,960	373.5	6 5/8	-	Base of Rustler	37.4	7/12/38	N,N,O	Cased to 239.5 ft. within 10 inch casing of well .110a. U. S. G. S. No. 3 test.
24.29.8.110a	-	1938	2,960	237	10	-	Rustler	30.5	7/12/38	N,N,O	Cased to 90.5 ft.
24.29.8.110b	-	1938	2,960	-	1 1/4	-	-	20.1	7/12/38	N,N,O	Same drill hole as .110a above. Cased to 28 ft. WBF: 19-66 ft.
24.29.9.410	Beeman, et al	1937	2,943	20	4	-	-	11.0	7/5/38	N,N,O	-

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24.29.11.340	Joe Livingston	1937	2,950	67.5	6 5/8	-	-	32.4	7/5/38	N,N,N	-
24.29.16.334a	-	1938	2,896	7.3	1	-	-	1.0	6/14/38	N,N,O	U. S. G. S. observation well.
24.29.20.222	-	1938	2,899	13.3	1	-	-	4.3	6/29/38	N,N,O	do.
24.30.36.333	-	-	3,359	480 ±	-	-	-	445.3	8/19/58	L,W,S	-
24.32.3.322	F. James	-	3,650	550	-	-	Triassic	-	-	L,W,D,S	-
24.32.15.122	do.	-	3,588	60	6	-	Alluvium	31.1	6/3/55	L,W,S	Located in sink.
24.33.10.113	C. Johnson	-	3,595	36±M	6½	-	do.	24.6	11/27/53	L,W,S	Located in bottom of Bell Lake.
24.33.23.311	-	-	3,565	232 M	9½	-	Triassic	208.6	11/27/53	N,N,N	-
24.33.23.444	"Holland Slick well"	-	3,350	-	5½	-	Alluvium	16.9	11/27/53	L,W,S	-
24.33.33.231	C. Johnson	-	3,460	-	6	-	-	93.2	3/17/54	L,W,D,S	3 wells here.
25.28.3.222	"Chinaberry well"	-	2,990	-	5	gyp (?)	Castile or Rustler (?)	32.3	12/6/48	L,W,S	-
25.28.5.331	-	-	3,020	-	-	gyp	Castile or Rustler	59.4	12/6/48	L, N	Unused (?).
25.28.15.230	J. Leck	-	2,960	-	6	do.	do.	48.9	12/6/48	L,Ic,S	-
25.28.18.324	"Northwest well"	-	3,035	-	-	do.	do.	66.9	12/6/48	L,W,S	-
25.28.29.410	Frank Neymeyer	-	2,970	60	6	do.	Castile, Rustler, or Alluvium	14.9	12/6/48	L,W,S	-
25.29.16.444	J. C. Ross estate	1957	3,042	180+M	6	-	-	170.1	8/19/58	L,W,S	"Pickett well". Driller: Tom Simmons. Depth greater than 180 ft., less than 200 ft.
25.29.32.211	Ross Brothers	-	2,966	698.5	8	gyp	Rustler	115.3	3/11/49	L,W,S	Plugged at 120 ft. Yield: 2 gpm. Well unused in 1958.
25.30.2.000	-	-	3,440	-	6	Red beds	Dockum (?)	295+	3/11/49	L,W,S,	-
25.30.8.220	-	-	3,195	343.5	7	-	-	309.7	8/19/58	N, N	Unused well; adjacent well 100 ft. W. is also unused.
25.30.9.100	Moore	-	3,235	-	6	Red beds	Rustler (?)	295+	3/10/49	L,W,S	-

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						Character of material	Stratigraphic unit	Depth below surface (ft)	Date of measurement		
25.30.9.100a	Moore	-	3,235	-	6	Red beds	Rustler (?)	295+	3/10/49	L,W,S	-
25.30.21.330	Mrs. Ross	-	3,157	280	-	do.	Alluvium (?)	268.0	3/10/49	L,W,S	Yield: 3 gpm.
25.30.21.333	do.	-	3,157	288.0	6	do.	do.	234 (?)	8/21/58	L,W,S	Yield: 2 gpm.
25.31.21.000	C. T. Ross	-	3,301	420	8	do.	do.	290	12/15/48	L,W,S	Yield: 3 gpm.
25.33.20.443	C. S. Brinninstool	-	3,420	-	6	-	-		8/18/58	L,W,S,D	Wet hole below 120 ft., sandy and muddy. Sounded to 250 ft. Water level greater than 200 ft., less than 250 ft.
25.33.31.244	N. Ritz	-	3,400	320	8	-	Triassic	257.5	7/26/54	L,W,S	
26.28.2.112	"Queen well"	-	2,910	-	-	gyp	Castile	21.2	12/6/48	L,W,S	Yield: 1½ gpm. Depth to water measured while pumping.
26.28.13.110	"Coad tank well"	after 1945	2,940	-	6	do.	do.	56.0	12/15/48	L,W,S	Yield: 3 gpm.
26.29.16.220	-	1948	2,933	1,028	8	Ss	Rustler (?)	125.0	3/11/49	L,W,S	-
26.29.22.340	J. G. Ross estate	1957	2,863	80 R 200(?) M	6	-	-	68.7	8/19/58	L,W,S,N	"Falls well". Unused stock well.
26.30.5.334	El Paso Natural Gas Co.	1942	-	770	10 3/4	S	Alluvium	173. R	-	T,Ic,In	Perf.: 180 to 289, 538 to 745 ft.
26.30.5.343	do.	1952	3,090	775	10 3/4 -8 5/8	do.	do.	183.8	8/18/58	T,Ic,In	Perf. from 145 to 353, 418 to 555, 530 to 755 ft. Casing dia. 10 3/4 in. to 570; 8 5/8 in. from 530 to 755 ft.
26.30.8.112	C. T. Ross	-	3,080	200	6	Red beds	Alluvium (?)	172.0	12/15/48	L,W,S	Yield: 3 gpm. Depth to water measured while pumping.
26.30.23.123	"King well"	1930	3,091	200+	7	do.	do.	167.7	4/24/40	L,W,S	Pumping about ½ gpm when measured.
26.31.1.000	Mrs. Ross	-	3,265	340	-	do.	Rustler (?)	287.7	3/10/49	L,W,S	East well of two.
26.31.8.310	C. T. Ross	1900 (?)	3,188	338	8	do.	Alluvium	188 R	8/18/58	L,W,Ic, D,S	"Ross headquarters well". Yield: 18 gpm R. 20 ft. of surface casing only in .310 and .310a
26.31.8.310a	do.	1945	3,188	326 M	6	do.	do.	275.8	8/18/58	N, N	100 ft. SW of .310 above.
26.32.21.322	Battle Ax Ranch	-	3,140	353	-	do.	Triassic	180 R	7/23/54	L,Ic,D, S	2 wells here.

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						Character of material	Stratigraphic unit	Depth below surface (ft)	Date of measurement		
26.33.3.444	W. D. Dinwiddie	-	3,315	180	6	-	-	102.8	7/23/54	N,N,N	2 wells here.
26.33.5.442	do.	old	3,330	-	6 3/4	-	-	dry at 148	8/18/58	N, N	Windmill tower, but no mill.
26.33.9.443	"Oats well"	-	3,280	-	-	-	Triassic	106.6	7/26/54	L,W,S,	-
26.33.22.433	Battle Ax Ranch	-	3,270	200(?)	6	-	-	79.7	7/26/54	L,W,S	-