THE GEOLOGICAL SURVEY OF WYOMING
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REPORT OF THE UNDERGROUND WATER RESOURCES OF THE EGBERT-PINE BLUFFS REGION

by

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Introduction.- The area covered in this report lies in the drainage basin of Lodgepole Creek between Pine Bluffs and Egbert, Wyoming. It is located in Townships 13 and 14 North, and Ranges 60 and 61 West, embracing approximately 90 square miles. The region is drained by Lodgepole Creek and its two small tributaries, Spring Creek to the north and Muddy Creek to the south. From Egbert to its junction with Muddy Creek Lodgepole Creek is an ephemeral stream, flowing only after periods of high precipitation. Muddy Creek is intermittent in the upper part of its course but ephemeral through the lower half. Spring Creek has only a short course but has a perennial flow.

Topography.- Most of the area lies in a wide rolling valley between two north-south escarpments. The eastern escarpment runs south from Pine Bluffs roughly paralleling the state line. It faces west and rises sharply about 200 feet above the valley floor. The western escarpment passes through Egbert and faces east. It is much less pronounced than the Pine Bluffs escarpment and the descent to the valley floor is more gradual.

Geology.- Only three formations outcrop within the boundaries of the Egbert-Pine Bluffs district. All are of Tertiary age and all dip gently to the east.

	Pliocene	- Ogallala Formation
Tertiary	Miocene	- Harrison Formation
	Oligocene	- Brule Formation

The Brule is a fine-grained, pinkish to cream colored, gritty clay which is made up of volcanic ash, for the most part, but contains a few sandy seams and lenses. It is a massive heavy-bedded formation and the bedding is only faintly discernable. In the upper part of the formation at exposed surfaces the rock is badly jointed and fractured. The Brule underlies the wide valley between the two escarpments mentioned above and passes east and west beneath the rocks forming the escarpments. The formation is Oligocene in age.

Overlying the Brule and forming the eastward facing escarpment that passes through Egbert is the Harrison formation. It consists, for the most part, of fine-grained gray impure sandstone with occasional lenses of gravel. In exposures near Egbert the rock is made up of fine wind-deposited sand, much of which appears to be reworked Brule. Farther west the sands become coarser in texture and contain more gravel lenses. The Harrison is Miocene in age.

Capping the high eastern escarpment and underlying the upland to the east is the Ogallala formation. It consists of poorly assorted clay, sand and gravel and contains many irregularly shaped concretions. The beds contain considerable calcareous sement and are consequently more resistant to erosion than the unerlying Brule "clay". It forms the upper 100 feet of the Pine Bluffs escarpment. The age of the Ogallala is Pliocene (?).

In the valley bottoms along Lodgepole Creek and along parts of Spring Creek and Muddy Creek there are deposits of gravel and silt which are not indicated on the accompanying map. They form a mantle over the valley bottoms immediately adjoining the streams, varying in thickness from a few feet up to 80 feet. The width of the deposits varies from a few hundred feet to approximately one mile.

Underground Water.- Practically all the water developed from underground sources in the Egbert-Pine Bluffs district is derived from the Brule formation. This rock in its unweathered state is practically impervious and is a poor acquifer except in its few sandy seams and lenses. In the weathered upper portion of the formation where it is jointed and fractured it is capable of storing considerable water. The joints and fractures are wide enough to release the contained water readily and hence forms a good acquifer. The movement of underground water through and along the openings has resulted in additional widening of the cracks through solution and in some of the wells of the district individual openings are as much as four or five inches by a foot or more in cross section.

The zone of jointed and broken rock extends to a variable depth through the district but averages around 60 to 80 feet. The lower limit of the zone conforms in general to the surface topography but with less relief. The rock in this zone of joints and fractures is not everywhere of the same character. Some beds are more brittle and hence more susceptible to jointing than others. This results, in some parts of the area, in an interbedding of broken water bearing beds and massive impervious beds. Where this interbedded character prevails water is sometimes encountered at depth which is under hydrostatic pressure and will rise in the well. Such a condition was encountered in the Wilkinson well in the southwest croner of Sec. 16, T. 14 N.,

R. 60 W. There water in quantity was encountered at 67 feet and rose to 16 feet from the surface. Pumping 1700 gallons per minute over extended periods lowers the level only to 19 feet.

The Fritz well, one mile east of the Wilkinson well, encountered water at 17 feet. The well was carried down to 60 feet with no change in level though there was an interbedding of jointed and massive rock all the way down. In the Campbell well, in the northwest quarter of Sec. 22, T. 14 N., R. 60 W., jointed rock was present through the entire 100 feet. Water was reached at 18 feet and held that level throughout.

The three cases above illustrate the variation in both the lateral and vertical behavior of the jointed zone in the Brule and its relation to the underground water. In the Campbell well the jointing is present throughout and the water behaves as though it were in a tank. In the Fritz well there is an interbedding of pervious and impervious beds but all the pervious beds are continuous with a zone such as that shown in the Campbell well and act as pipes connected at different depths to a single tank filled with water. In the Wilkinson well the zone encountered at 67 feet has the most open connection to such a zone as that of the Campbell well and acts like a pipe connected near the bottom of a tank.

Though gravels are associated with the streams of the region it is only in a few localities that they are saturated with water. In most cases where wells have encountered gravel the gravel is dry and water is reached below in the Brule "clay". In some stretches of Lodgepole Creek the water table is high enough that the gravels are saturated. In the Jim Wilkinson well in Sec. 11, T. 14 N., R. 60 W. gravel was present to 80 feet, the bottom of the well. The water level was reached at 17 feet. Here the old channel of Lodgepole Creek is quite deep and is filled with gravel. The depth of the gravel is such that it extends considerably below the water table and forms a very good water producer.

Sources of Water.- There are two sources of water which replenish the underground supplies in the Egbert-Pine Bluffs district. The first and most important is the precipitation within the area itself. The greater part of the annual precipitation seeps into the ground and eventually finds its way to the saturated zone below. Most of the seepage takes place in the valleys, the water running off the slopes into the valleys and seeping into the ground there. Hence, there is a greater concentration of underground water beneath the valleys, both from greater inflow and from the fact that the jointed porous zone conforms in general to the topography and the underground water moves into and down the valleys. The greater the drainage area of the individual valleys the greater is the concentration of underground water. At the same time the depth of the water table is less in the valleys than on the valley sides and on the ridges.

The following table gives the normal precipitation and the 1935 precipitation for the Pine Bluffs region.

Normal Precipitation

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
0.27	0.51	0.96	2.22	2.28	2.15	2.27	2.14	1.55	1.28	0.46	0.63	16.60

1935 Precipitation

T	0.25	0.79	2.54	4.35	3.33	1.45	0.45	1.82	0.52	0.45	0.33	16.24

The other sources of water is Lodgepole Creek which is the only through stream in the area. Lodgepole collects water from the Laramie Range east to Egbert. Between Egbert and the mountains, however, water is diverted several times with consequent loss through evaporation and plant transpiration. Lodgepole Creek is a perennial stream through parts of its course with intermediate epheneral stretches. The disappearance of the surface flow at Egbert coincides with the contact of the Harrison and the Brule. Below Egbert the water has apparently seeped into the broken Upper Brule, leaving the stream gravels dry except in a few short stretches.

The flow in the perennial stretch of Lodgepole Creek above Egbert is approximately 1 to 2 second feet. At the Wyoming-Nebraska line two measurements made in August, 1895, and May, 1904, give 3.50 and 4.30 second feet respectively. No figures are available for the underflow of Lodgepole above Egbert but it is probably less than the underflow at the State line so the inflow on the only through stream is less than one half the outflow.

Conclusions and Recommendations.- From the data available a map has been constructed outlining the zones in which the water table is within 20 feet of the surface, and from 20 to 40 feet of the surface. These zones lie in the valleys and on the lower portions of the valley sides. The

large producing wells in the area fall within the two zones outlined on the map. Owing to the variation in the distribution and character of the fracture zones and to the fact that these zones cannot be determined by surface observations, it is impossible to state definitely where and at what depth additional water in large quantities can be developed from underground sources. It is believed, however, that the best possibility of developing water in sufficient quantity for irrigation is within the zone where the water table is less than 40 feet from the surface. The greatest potential supplies lie beneath the portions of the larger valleys along and adjacent to the stream channels.

The following table contains all the available well data upon which this report is based.

Tentative Estimate of the Amount of Underground Water in the Valley of Lodgepole Creek, between Egbert and Pine Bluffs, Laramie County, Wyoming

The underground water of Lodgepole Creek is contained in fissures which cut the Brule formation. The extent, size and distribution of these fissures is impossible to determine, consequently any estimate of the total volume of water is a matter of judgment based upon ascertainable data. The following estimates treat with that portion of the area in which the water table is within forty feet of the surface and are believed to be conservative.

Water enters the fissures in the Brule from two sources: (1) run-off from the valley slopes, (2) from Lodgepole Creek.

I Estimates of volume of water entering the underground water zone from valley slope run-off.

A Normal precipitation 16.60 inches

B Total precipitation for immediate drainage area of 90 square miles . . . . . 82,650 acre feet

C Estimated amount of run-off entering the ground water zone = 20% of total. (It is believed that the amount of run-off entering the ground water zone is unusually high as shown by the fact that Lodgepole Creek is dry between Egbert and Pine Bluffs except during periods of flood or when the ground is frozen . . . . . 16,532 a

D Total mean annual recharge rate from valley slope run-off . . . . . 16,532 acre feet

I Estimated volume of water entering the underground water zone from Lodgepole Creek.

a. Annual amount of surface flow of Lodgepole Creek entering underground water zone above Egbert (1 second foot) - 724 acre feet.

E Total mean annual recharge rate from Lodgepole Creek . . . . . 724 acre feet

Total annual recharge rate . . . . . 17,256 acre feet

F Total area in which the water table is within 40 feet of the surface . . . . . 32,640 acres

G Assumed available porosity through fissures in the upper portion of the Brule formation - 3%.

H The saturated zone where the water table is within 40 feet of the surface would therefore contain in the upper ten feet . . . . . 9,792 acre feet

I During the 1936 irrigation season there were withdrawn from the ground-water zone through large capacity wells approximately 1,500 acre feet

(Note: this figure does not include water withdrawn from small capacity wells.)

Conclusions

No figures are available for the fluctuations of the water table due to seasonal variations or heavy pumping. Nor are there any figures available as to the lateral extent of the cone of influenece of any of the large wells of the area. Lacking the above information, recommendations for a safe increase in the number of wells in the Egbert-Pine Bluffs Region must be based on the foregoing figures.

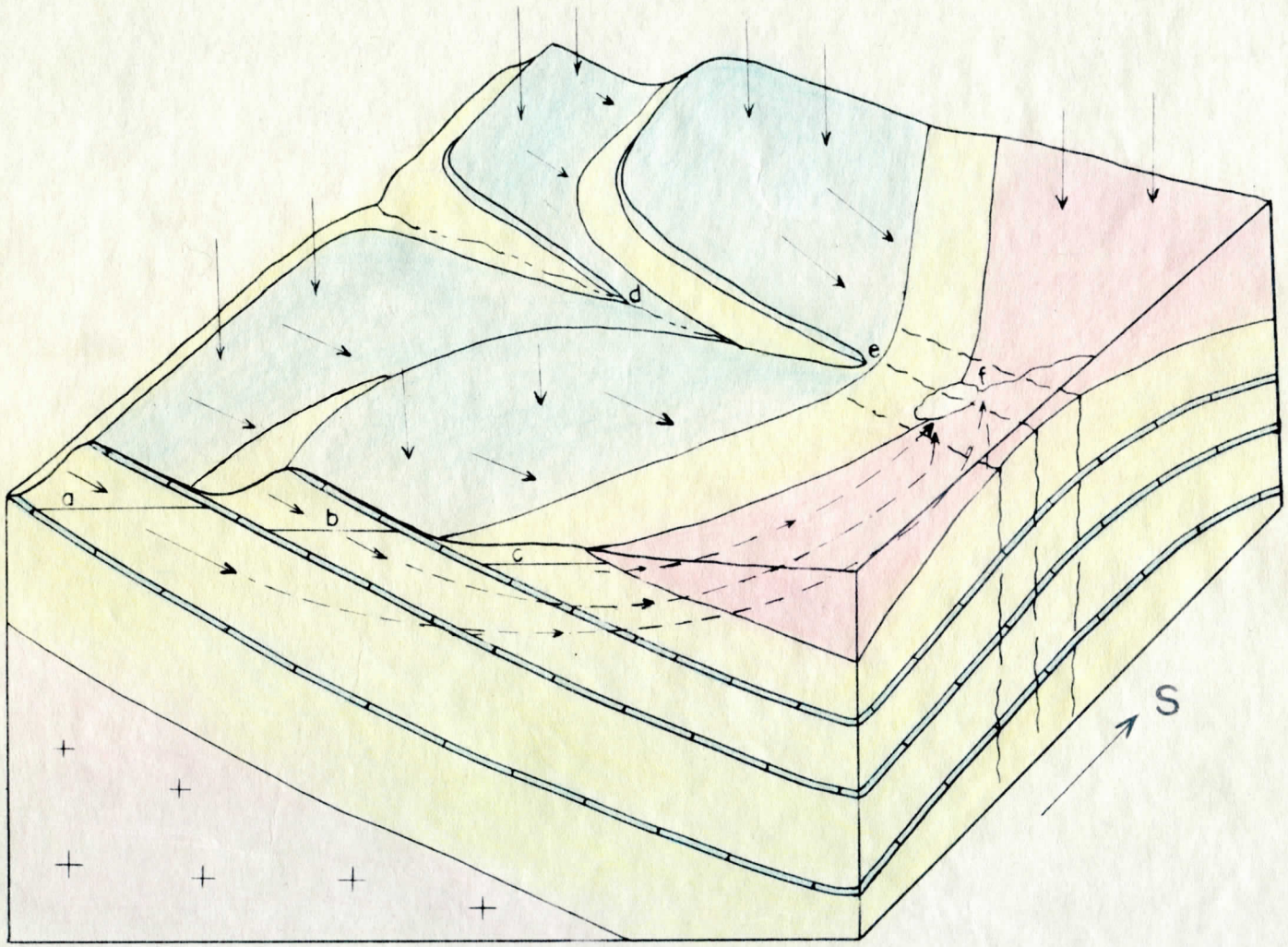
A. It is believed that the storage capacity of the underlying rock and the annual recharge of the saturated zone is great enough to safely support an increase of at least six times the existing withdrawal from underground water sources.

B. Care must be exercised in spacing additional wells to prevent interference with one another and with those already in existence. Measurements and observations on existing groups of wells such as the Campbell and Foster wells should give information upon which to base recommendations for spacing additional wells.

Name	Locality	Depth To Water	Depth of Well	Size of Well	Capacity Gal. per Min.
Bledsoe, E.F.	Sec. 19, T. 14, R. 61	20 feet	45 feet	5 inches	
Johnson, Glen	Egbert (NW¼)	15-20 "	40 "	6 "	
	Well at center north line of Egbert	15-20 "	45 "	--	
Bomhoff, Tracy	SE cor. Sec. 18, T. 14, R. 61	26 "	35 "	5 "	
Baker	NW cor. Sec. 19, T. 14, R. 61 (Old Carpenter Well)	26 "	200 "		large production
Baker	Center SE¼ Sec. 13, T. 14, R. 62 (Old Carpenter Well)		50? "		2000 gals. per minute
Tucker, Bert	NW¼ Sec. 18, T. 14, R. 61 (100 yds from creek)	20 "	45 "	5 "	
Klugherz	SE¼ Sec. 17, T. 14, R. 61	10? "	35 "		
Curry, W.M.	NW¼ Sec. 20, T. 14, R. 61	14 "	20 "	6 "	
	100 yds. east of above	--	35 "		
	⅛ mile south (near creek)	9 "	--		
Ryland	NW cor. NE¼ Sec. 20, T. 14, R. 61	40 "	60 "	dug	
Brillhart	NE cor. Sec. 8, T. 14, R. 61	235 "	240 "	6 "	1 bucket per day
	NE cor. SE¼ Sec. 8, T. 14, R. 61	179 "	180 "	dug (4')	2 bbls. per day
	250 yds. south of above	117 "	123 "	5 "	
	SW¼ Sec. 9, T. 14, R. 61	---	260 "	5 "	4 head stock
Brillhart	NW¼ Sec. 16, T. 14, R. 61	51 "	57 "		

Brown	NE cor. SE¼ Sec. 34, T. 14, R. 61	40 (52)	70feet	
	100 yards south of above	125? feet	135 "	
Deal	NW cor. Sec. 34, T. 14, R. 61	40 "	70 "	
Brown ?	SW cor. Sec. 26, T. 14, R. 61	28 "		
	SE cor. Sec. 27, T. 14, R. 61	28 "		
Brown	SE¼ Sec. 26, T. 14, R. 61 (center of ¼)	40 "	130 "	
	150 yards west of above	40 "	134 "	
	NW¼ Sec. 26, T. 14, R. 61 (center W. line)	14 "	102 "	
Stubbs	SW cor. NW¼ Sec. 28, T. 14, R. 61	--	35 "	
Palmer	NE cor. Sec. 32, T. 14, R. 61	100 "	115 "	12000 gals. per day

Fig. 1



LEGEND

Shale

Limestone

Sandstone

Granite

Paullin	NW cor. SW¼ Sec. 20, T. 14, R. 60	40 feet	32 feet		300 gals. per minute
	NW cor. Sec. 29, T. 14, R. 60	40 (80)	112 "		
	NE cor. Sec. 30, T. 14, R. 60	40 feet	50 "		
	center SW¼ Sec. 29, T. 14, R. 60	40 "	51 "		
Wilkinson	SW cor. Sec. 16, T. 14, R. 60	62 (15?)	77 "	15 inches	1600 gals. per minute
	SE cor. Sec. 16, T. 14, R. 60	26 feet			1000 gals. per minute
	SW cor. Sec. 15, T. 14, R. 60	none?	140		
Fritz	NW cor. Sec. 22, T. 14, R. 60	17 feet	30 "	8 "	500 gals. per minute
		17 "	60 "	18 "	
Droessler	SW cor. Sec. 10, T. 14, R. 60	5 "	60 "		1000 gals. per minute
Butler	SW cor. SE¼ Sec. 10, T. 14, R. 60	22 "	140 "		600 gals. per minute
Wilkinson	SW cor. NW¼ Sec. 11, T. 14, R. 60	17 "	65 "		1000 gals. per minute
U.P.R.R.	Pine Bluffs	12 "	25 "	14 feet	350 gals. per minute
Pine Bluffs Waterworks		16 "	76 "	12 inches	750 gals. per minute
Campbell	NW¼ Sec. 28, T. 14, R. 60 (center W. line)	18 "	100 "		1500 gals. per minute
	NW cor. SW¼ Sec. 28, T. 14, R. 60	18 "	85 "		400 gals. per minute
	80 rods south of above	18 "	85 "		pumps dry 15 gals.
Foster	SE cor. Sec. 32, T. 14, R. 60	42 "	100 "		6 in. pump
	Center Sec. 32, T. 14, R. 60	42 "	100 "		8 in. pump
	Center NW¼ Sec. 32, T. 14, R. 60	42 "	100 "		
Campbell	NW¼ Sec. 5, T. 13, R. 60 (center W. line)	20 "	85 "	24 inches	400 gals. per minute
	NE¼ Sec. 6, T. 13, R. 60 (center E. line)	20 "	85 "	18 "	200 gals. per minute
	SW¼ Sec. 5, T. 13, R. 60 (center W. line)	20 "	85 "	24 "	400 gals. per minute
	100 yards east of above	20 "	85 "	18 "	175 gals. per minute

Keyser	NW¼ Sec. w1, T. 14, R. 61	40 feet	110 feet	8 inches	500 gals. per min.
	center W. line	28 "	42 "	8 "	625 gals. per min.
	center So. line	60 "	105 "	8 "	250 gals. per min.
	center No. line				
Bymer	NW cor. NE¼ Sec. 21, T. 14, R. 61	80 "	100 "		
	SE cor. SE¼ Sec. 21, T. 14, R. 61	4 "	21 "		
Barkel	NE cor. NE¼ Sec. 22, T. 14, R. 61	56 "	73 "	dug	
	SW cor. SE¼ Sec. 22, T. 14, R. 61	--	30 "		
	SW cor. SW¼ Sec. 14, T. 14, R. 61	28 "	30 "		
	SE¼ Sec. 15, T. 14, R. 61 (center so. line)				
Bogie	SE cor. Sec. 10, T. 14, R. 61	60 "	70 "		
	SW¼ Sec. 2, T. 14, R. 61	50 "	60 "		
Eggers	NE cor. NW¼ Sec. 14, T. 14, R. 61	50 "	75 "		
	50 yds. east of above	50 "	75 "		
	Center of Sec. 14, T. 14, R. 61	26 "	30 "		
Floy	SE cor. SE¼ Sec. 14, T. 14, R. 61				
Floy	SE cor. SW¼ Sec. 13, T. 14, R. 61				
Paullin	SE cor. Sec. 18, T. 14, R. 60	20 "	55 "	6 "	
Wisroth	NW¼ Sec. 8, T. 14, R. 60	22 "	65 "		
	NE¼ Sec. 8, T. 14, R. 60	8 "	18 "		
	SE¼ Sec. 8, T. 14, R. 60	34 "	55 "		
Brown	SW¼ Sec. 20, T. 14, R. 60 (center No. line)	40 "	100 "	6 "	

Larsen	SE cor. Sec. 19, T. 13, R. 60	30 feet	50 feet		1000 gals. per day
Joyce	NW¼ Sec. 20, T. 13, R. 60 (center W. line)	58 (90)	100 "	24 inches	300 gals. per minute
	200 yards east	60 (82)	472 "		
Whited	SE¼ Sec. 24, T. 13, R. 61	34 feet	60 "		
Merril	NW¼ Sec. 24, T. 13, R. 61	40 "	60 "		
Papke	NE cor. Sec. 14, T. 13, R. 61	12 "	20 "		
	100 yards west of above	8 "	20 "		
	100 yards west of above	10 "	20 "		
Owens	NE¼ Sec. 14, T. 13, R. 61 (center E. line)	36? "	37 "		
	150 yards SW of above	9 "	17 "		
Cordel	NW cor. Sec. 13, T. 31, R. 61	22 "	50 "	8 inches	
Dolan	SE¼ Sec. 11, T. 13, R. 61 (center E. line)				
	NW cor. SE¼ Sec. 11, T. 13, R. 61				
Sanders	SW cor. NW¼ Sec. 1, T. 13, R. 61		240 "		
Cloyd	NE cor. Sec. 22, T. 13, R. 61	44 "	68 "	6 "	
	SE cor. Sec. 22, T. 13, R. 61	16 "	35 "		
Shaefer	SE¼ Sec. 10, T. 13, R. 61 (center E. line)	50 "	98 "	8 "	
	NE cor. Sec. 9, T. 13, R. 61	4 "	20 "		
Suchmal	NE cor. Sec. 35, T. 14, R. 61	38 (52)			

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MAP SHOWING GEOLOGY AND POSITION OF THE WATER TABLE OF THE EGBERT-PINE BLUFFS AREA

by

Arthur M. Morgan

1936

SCALE: 2 INCHES = 1 MILE

0 1 2 3 MILES

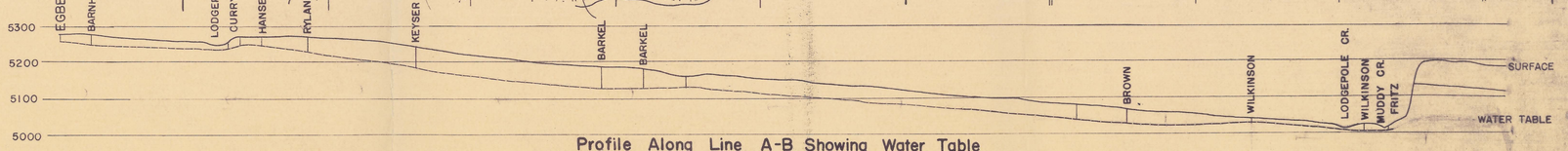
CONTOUR INTERVAL 50 FEET — CONTOURS APPROXIMATE

LEGEND

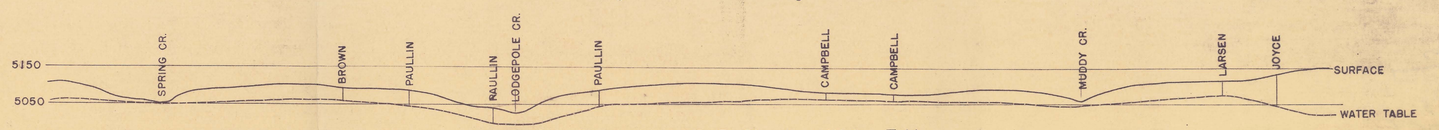
PLIOCENE	To	OGALLALA	Water Table Less Than 20 Feet From The Surface
MIOCENE	Thr	HARRISON	Water Table 20 to 40 Feet From The Surface
OLIGOCENE	Tb	BRULE	Water Table More Than 40 Feet From The Surface

Well, With Depth To Water Table

Well Producing More Than 500 Gallons per Minute



Profile Along Line A-B Showing Water Table



Profile Along Line C-D Showing Water Table

Horizontal Scale: 2 Inches = 1 Mile Vertical Scale: 1 inch = 200 Feet