J. D. Love, 1934

GEOLOGICAL REPORT OF THE UNDERGROUND WATER RESOURCES OF THE COLTER DISTRICT, WASHAKIE COUNTY, WYOMING

-by-

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CONCLUSIONS:

1. There are two horizons at which artesian water could be encountered; the first at a depth of 267 to 272 feet and the second at a depth of 334 to 345 feet.

2. The maximum combined flow which could be expected from these two horizons would not exceed 250 gallons per hour or 6000 gallons per day, and it is extremely doubtful if they would yield that much without pumping.

3. A considerably greater flow could be obtained by pumping.

4. Pumps would have to be installed to force the water into the storage tank, as the maximum hydrostatic pressure is only a few ounces.

5. There is enough water known to be present to justify a test boring.

6. The water will be fit for boiler purposes and for domestic use, and will not need a softener, due to its extreme softness.

7. Judging by all available data the artesian horizons should not dry up, but maintain a more or less steady supply.

8. It is not considered feasible to attempt to develop water at a greater depth.

9. The oil well hole is valueless and should be plugged and abandoned.

ESTIMATE OF COSTS:

1.	80 feet of 10-inch casing, per foot 75¢	$ 60.00
	270 feet of 8-inch casing, per foot 50¢	135.00
2.	Drilling costs $2.00 per foot	700.00
3.	Miscellaneous expense	150.00
	TOTAL COST	$995.00

These estimated costs were obtained from local drillers who stated that they could and would put down an 8" hole to a depth of 350 feet for the above figure.

RECOMMENDATIONS:

1. That a test well as described above be put down in the SE¼, NE¼, Sec. 16, T. 46 N., T. 93 W.

2. That the Empire States oil well on the Industrial Institute property be plugged and abandoned, rather than have it fixed up. The cost of cleaning and fixing properly would not justify the amount of water which would be obtained.

LOCATION:

The area discussed in this report is located along the Bighorn River in the central part of Washakie County, Wyoming.

FIELD WORK AND ACKNOWLEDGEMENTS:

A geologic map of T. 45 N., and T. 46 N., Range 93 W., and R. 94 W., was made and all the available data on water and oil wells drilled in the region was compiled. The United States Geological Survey map of Wyoming was used as the base map for the geology of the region. Most of the formational boundaries were roughly checked in the field by means of the use of a Brunton pocket transit and section corners. The topography and drainage of the region was studied with respect to the source of the underground water. For information in regard to well logs and water analyses the writer is deeply indebted to Mr. John G. Bartram, Chief Geologist for the Stanolind Oil Company, and to Mr. Pierre LaFleiche, State Mineral Supervisor.

TOPOGRAPHY AND DRAINAGE:

The topography in the southern parts of T. 45 N., ranges 93 and 94 W., is extremely rough. The region is in a stage of youth or early maturity. Differential erosion of the northward-dipping hard sandstone and soft shale beds in the Mesaverde formation has also contributed to the high relief. In the central parts of T. 45 N., ranges 93 and 94 W., the topography is not so rough because the beds flatten out in the trough of a syncline. Just to the north and extending into the

southern part of T. 46 N., T. 93 W., and R. 94 W., is the Neiber dome uplift. Here again the topography is rough due to differential erosion of the hard and soft beds in the Fort Union formation. To the north of the Neiber dome the topography flattens out, especially along the valley of the Bighorn River. On the west side of the river the topography is rougher and the general elevation considerably higher than on the eastern side.

The region discussed in this report is drained by four perennial streams; The Bighorn River, Cottonwood Creek, Gooseberry Creek and No Water Creek. The Bighorn River is entrenched about 100 feet into a broad flat flood plain, upon which most of the farming of the region is done. Cottonwood Creek flows through a narrow valley into the Bighorn River at Winchester. Gooseberry Creek flows across the southern part of the Bighorn Basin through some rolling hills, but as it approaches the Bighorn River at Neiber the valley broadens and the relief is not so high. There is water only in the lower end of No Water Creek and it has no significance in the problem of underground water in this region.

DESCRIPTION OF GEOLOGICAL FORMATIONS:

Mesaverde formation.

In this area the Mesaverde formation, of Upper Cretaceous age, consists of alternating sequences of sandstones, gray to black shales, and coal beds of marine and brackish water origin. As this formation has no bearing on the problem, further discussion will be omitted.

Lance Creek formation.

Overlying the Mesaverde with apparent conformity is the Lance Creek formation, also of Upper Cretaceous age. The Lance Creek formation consists mainly of buff, brownish red and gray sandstone, buff, gray and balck shales and some thin coal beds, of continental and brackish water origin. The total thickness is not known

because of an unconformity at the base of the overlying Fort Union formation.

Fort Union formation.

The Fort Union formation lies with a slight angular unconformity on the Lance Creek in this area. At the present time the Fort Union is considered to be of Basal Eocene age, and in this area consists mainly of buff to gray sandstone, gray to black shales and some lignitic beds of brackish water and continental origin. Many of the sandstones are soft and porous. The total thickness is not known as the top is not exposed.

Wasatch formation.

The Wasatch formation of Lower Eocene age lies with a distinct angular unconformity across all the older sediments. For the most part the Wasatch of this area consists of gray, brown, and white sandstones and drab shales of fluviatile origin. Sandstones predominate and are usually coarsely bedded but in some places along the east side of the Bighorn River a massive soft gray sandstone at least 30 feet thick was observed. The Wasatch is poorly consolidated and in the vicinity of Colter is probably not more than 100 to 150 feet thick. There are a few lenticular pink shales, but they are not a conspicuous feature.

Quaternary Alluvium.

There is very little alluvium in this area. Along the flood plain of the Bighorn River there are seldom more than 20 feet of gravel, sand and clay, and usually not that much.

STRUCTURAL RELATIONSHIPS:

The structure of this region is comparatively simple, for it is a considerable distance from the mountains and there has been no intense folding or faulting. In the southern part of the area the Mesaverde and Lance Creek dip gently to the north at an angle of about 5° to 10°. The beds flatten out in the northern part of T. 45N., R. 93 W., and R. 94 W., into a broad, gentle syncline. Just north of this syncline,

along the township line, the beds of Fort Union age are arched upward into a well-defined dome, with the beds on its flanks dipping from 10° to 20°. This is known as the Neiber dome, Unconformably overlapping the Fort Union formation and almost entirely surrounding the Neiber dome is the Wasatch formation. Although the contact between these two formations is obscured, there must have been a considerable time interval represented by a period of gentle folding and subsequent erosion between the two cycles of sedimentation. There is no evidence of diastrophism from the beginning of Lower Eocene time to the present. The Wasatch beds dip gently toward the basin to the north with a dip of 4° down to approximately 30'. This is probably the original dip of the sediments as they were deposited, and constitutes no evidence of a subsequent period of folding or tilting. Throughout the entire exposures in this area the beds have an almost uniform dip and strike. No reversals of dip in the Wasatch beds was observed.

KNOWN WATER-BEARING HORIZONS:

The known water-bearing horizons will be discussed separately with reference to their depth, thickness, character of water and possible yield, as developed beneath the SE¼ of NE¼, Sec. 16, T. 46 N., R. 93 W.

Water Sands in Quaternary Alluvium.

There are about 20 feet of river sands and gravels and reworked Wasatch overlying the formation in place. This alluvial material contains surface water which is probably somewhat contaminated and is in too small a quantity to be worth developing.

Wasatch Water Sands.

The thickness of the Wasatch is not known but probably does not exceed 150 feet. There are no important water sands in this formation. It consists mainly of sandy bluish shale, a few pink shales and thin sandstone lenses. The sandstone lenses and sandy shales yield a small amount of water, most of it coming from a depth of 60 to 90 feet. The water is not abundant and, although it may rise some distance in

the hole, will not reach the surface. An analysis of the water by the State Chemist is as follows:

Parts per 100,000:

Free ammonia	0.15
Albuminoid ammonia	trace
Nitrates	none
Nitrites	none
Chlorine	8.0
Oxygen consumed	none
Hardness	22.2
Total solids	242.0
Fixed solids	239.0
Colon bacilli, per cc	none
Total bacteria, per cc	80

Remarks: Fit for stock and domestic use.

Fort Union Water Sands.

The Fort Union formation is at least 2550 feet thick as is shown by the log of a well drilled for oil on the Institute grounds. This well was drilled to a depth of 2705 feet and encountered a number of water sands, only two of which are worthy of consideration. The first one was encountered at a depth of 267 feet and was found to be five feet thick. This was a flowing artesian water sand and yielded approximately 150 gallons of water per hour over the top of the casing.

The second water sand was encountered at a depth of 334 feet and was found to be eleven feet thick. This white sand was also found to be a flowing artesian water horizon, and it yielded approximately 50 gallons per hour over the top of the casing.

An analysis of this water by the State Chemist is as follows:

Parts per 100,000:

Odor	none
Color	none
Turbidity	none
Sediment	none
Free ammonia	none
Albuminoid ammonia	0.0030
Nitrates	none
Nitrites	none
Chlorine	33.6
Oxygen consumed	0.06

Hardness	2.9
Total solids	147.5
Fixed solids	108.5
Colon bacilli	none
Total bacteria, per cc.....	450

Remarks: Water is satisfactory condition for domestic use.

Small quantities of an inflammable gas, possible methane, bubble up with the water. The well was never plugged or cemented properly and the hole is open at each place the casing size was changed. At present there is considerable mud and sand in the hole and an iron obstruction has been reported at a depth of 367 feet 5 inches. The casing is also reported to be split, although the position of the break is not known. At present the well is flowing a very small intermittent stream from an inch pipe, into a stock trough. Several attempts have been made to determine the possible yield from these water horizons by means of pumping but in each instance so much mud was sucked into the faulty casing that no conclusive results could be obtained.

The source of the water in these two artesian horizons is probably both Gooseberry Creek and the Bighorn River. As may be seen in the cross-section of the accompanying map, Gooseberry Creek flows southeast across the Wasatch, almost at the contact with the Fort Union. Water fromthis creek, flowing roughly along the strike nearthe junction with the Bighorn River, probably seeps down into the supper sandstone beds of the Fort Union.

In the vicinity of Neiber the river cuts across the outcrop of sandstone beds taken to be the two artesian water horizons encountered at Colter. As there is an angular as well as erosional undonformity between the Fort Union and Wasatch beds this correlation can only be tentative, but assuming that it is correct, the water would work its way down the sandstone beds from these two sources. It would be kept from rising to horizons higher in the succession by some impervious shale beds overlying the sandstones, and kept from sinking by some blue shale below the

sandstones. Allowing for friction loss there is just about enough difference in elevation between the outcrop of the aquifer beds and the surface level at Colter to account for the water barely flowing over the top of the casing with only a few ounces pressure.

Signed: _____
David Love, Field Geologist

Checked & approved: _____
S. H. Knight, State Geologist

December 5, 1934